AUGUST 1958

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# ILLUMINATING ENGINEERING

*Journal of the*
ILLUMINATING ENGINEERING SOCIETY

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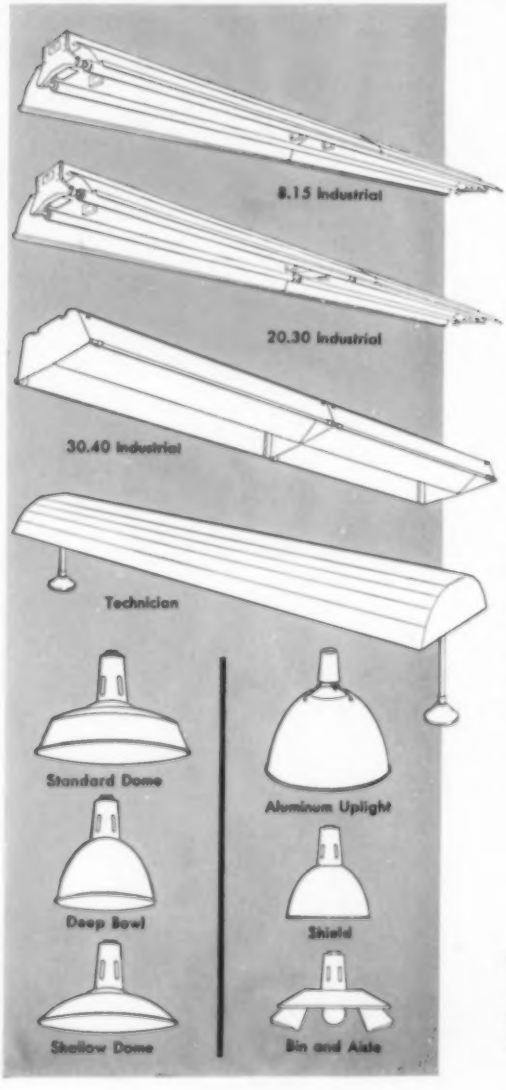


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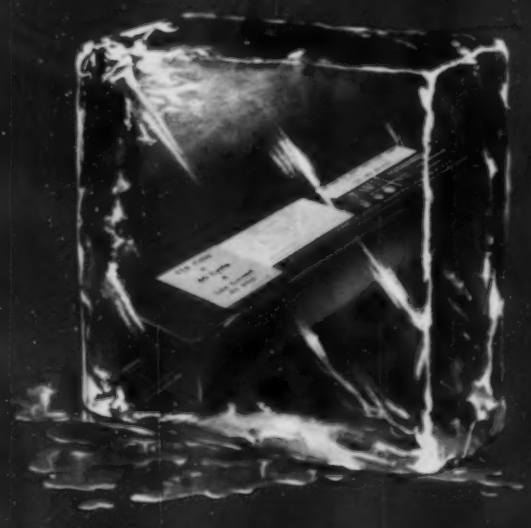

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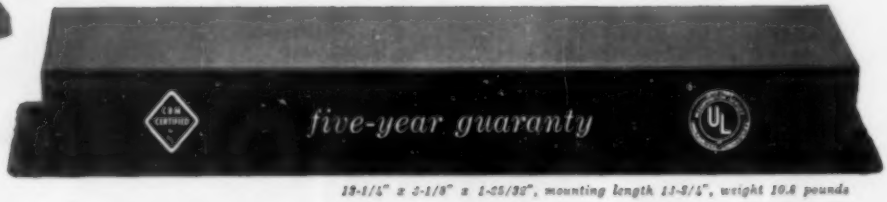


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THE JOURNAL OF THE ILLUMINATING ENGINEERING SOCIETY

August 1958

Vol. LIII, No. 8

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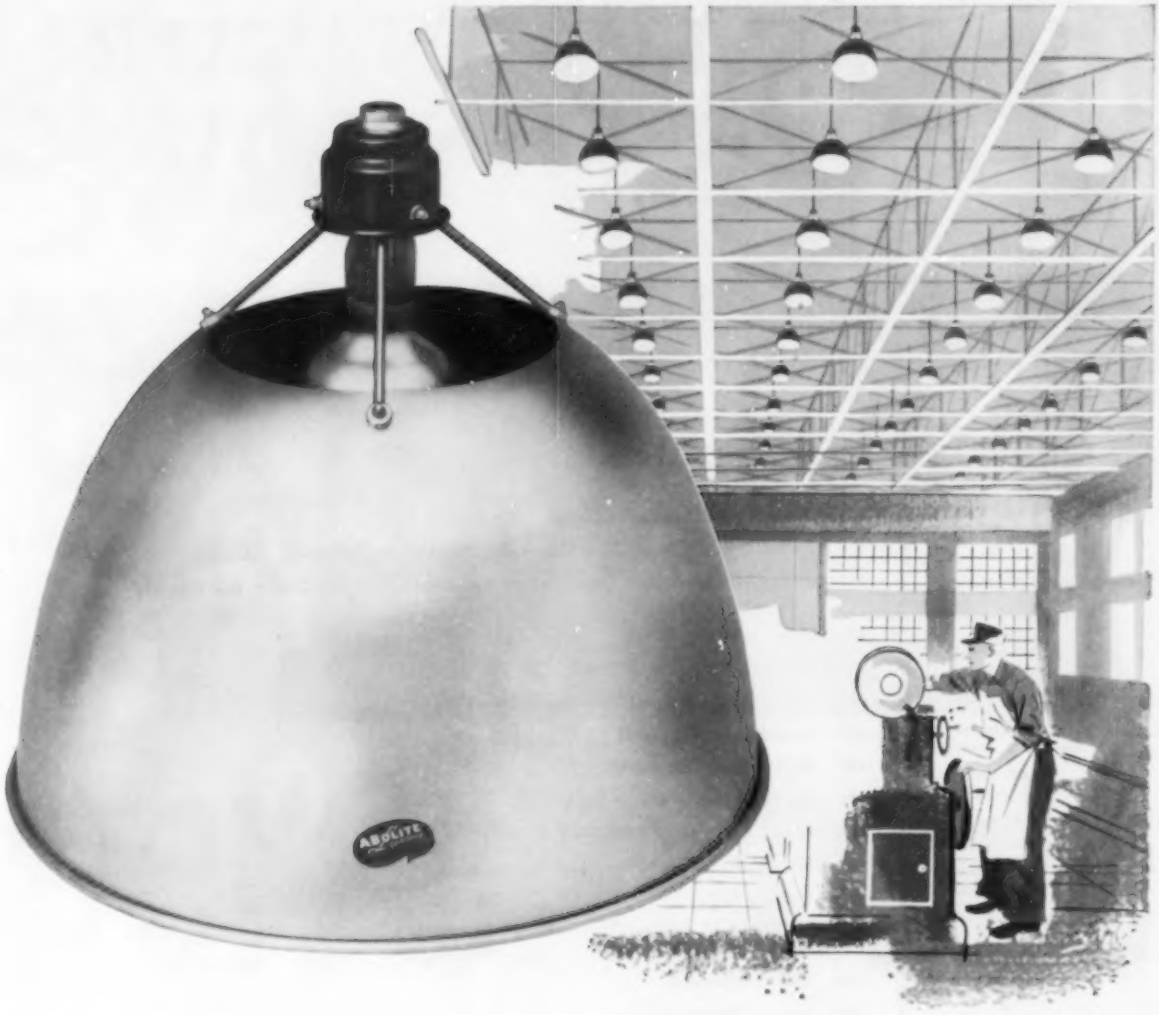


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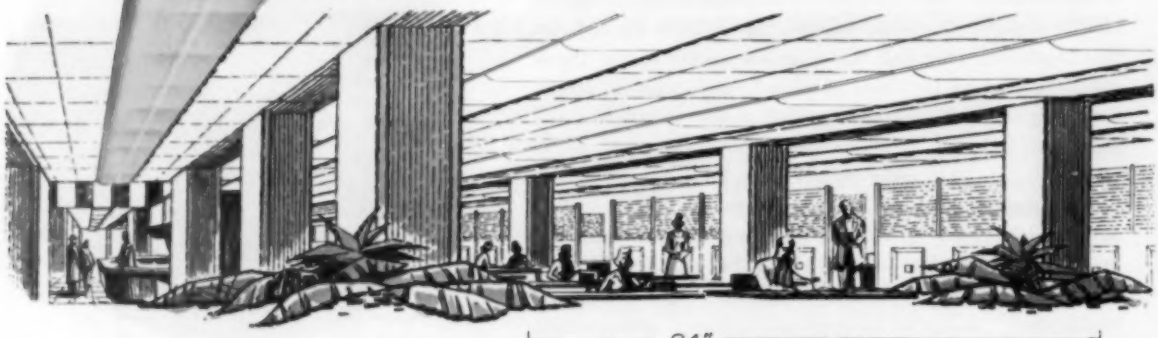

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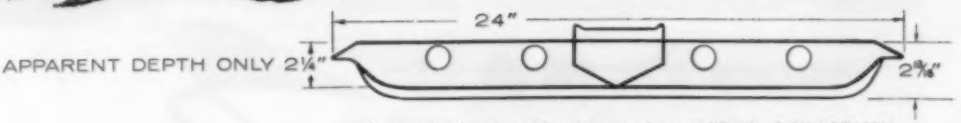


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# Recommended Levels of Illumination

In the April 1958 issue of Illuminating Engineering, a report was published covering the Illuminating Engineering Research Institute's Symposium at Dearborn, Mich., at which was presented a new basis for establishing required footcandle levels. Details of this research, led by Dr. H. Richard Blackwell, are being given by Dr. Blackwell at the IES National Technical Conference in Toronto, August 19. This paper, together with discussion of it, will subsequently be published in Illuminating Engineering.

In advance of Dr. Blackwell's paper, C. L. Crouch, Technical Director of IES and Secretary of the Research Institute, has herein (page 416) summarized the events leading to the Blackwell studies and described the research procedure used.

Following this is the report (page 422) prepared by the IES Committee on Recommendations for Quantity and Quality of Illumination, based on their analysis of the research findings. The new footcandle recommendations for various specific eye tasks, agreed upon by IES Technical Committees, are next presented (page 425).

Finally (page 432) IES President Kirk M. Reid outlines some of the other research projects of the Illuminating Engineering Research Institute and the relationship of the Society to the IERI.

# New Method of Determining Illumination Required for Tasks

By C. L. CROUCH

Ever since the establishment of the Society 52 years ago, the basic question has been: "How much light is required for seeing?" Over the years I.E.S. application committees have, with agreement among themselves, recommended levels of illumination for their various fields, which were based on the then current data available to them. These recommendations have not always been accepted without question. In 1937, for example, discussions in the National Council for Schoolhouse Construction questioned the soundness of the Society's recommendations for school lighting. And in 1946, the American Public Health Association spoke informally in an editorial about the Society's recommended levels, questioning their basis. The Society responded, stating the basis of its values, and an amicable conclusion was reached. Both these organizations were satisfied that the engineers had used what evidence was available, to reach their conclusions and recommendations. *All* of the evidence was not in, it was realized; lighting knowledge was not yet complete.

## Previous Methods

In the very early days the limitations of "what one could get" established the levels to be currently recommended. Light sources were feeble at best. Equipments had their limitations also. Later (late "teens" and early twenties), the increase in the ability to see fine detail (visual acuity) with increased illumination was used as an index for the need of light. Coupled with this were reports from the industrial field showing an increase of production with increases of illumination up to twenty-five footcandles.

Where size of detail had been the sole index previously, Cobb and Moss, in the late twenties, determined the relationships between the four fundamental factors of seeing: size of detail, contrast of detail with background, time interval of seeing—all varying with the brightness of the tasks. From this and other evidences of visual effects, Dr. Luckiesh and his associates developed the "Science of Seeing." The end-use in the field developed into a "visibility meter" whereby various unknown visual tasks could be related to an assumed standard task (eight-point Bodoni type, published material) under 10 footcandles.

In 1935, Weston in England started a study to determine the relative visual performance (time of performance) of a simulated field task (marking the opening of a Landolt Ring, or "C") depending upon its size and contrast. This work was carried out from 1935 through 1945 under the auspices of the Medical Research Council. This allowed the assumption that a given task with its particular size of detail and its contrast would be seen the same as that involved in cancelling a Landolt ring of the same size and contrast. The Weston system provided the Society in the Post-World War II period with a method of determining the footcandles of illumination needed for various field tasks. No. 2 pencil writing on white paper was selected as the basic task for classrooms and offices and the footcandles were determined for the "Recommended Practice of Office Lighting," and the 1948 "American Standard Practice for School

**Figure 1. Normal young observers measure relationships of size, contrast, time and accuracy of seeing a luminous disc — all varying with various levels of brightness in the cubicle.**

Author: Technical Director, Illuminating Engineering Society, and Secretary, Illuminating Engineering Research Institute.

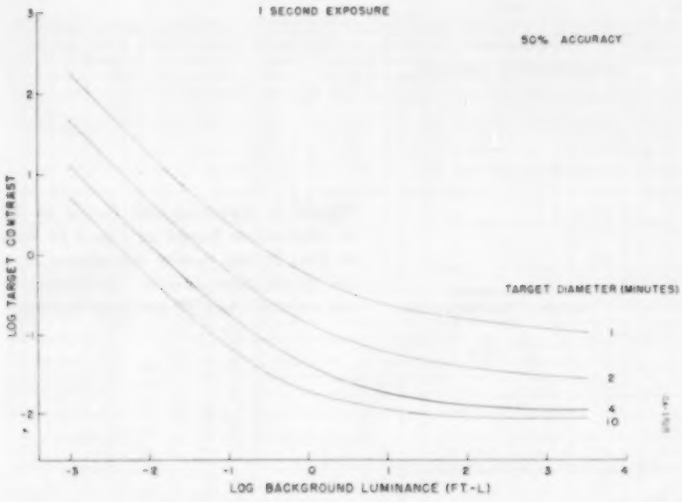



**Figure 2. Results of measurements of laboratory task (disc) for sizes of 1 to 10 minutes, time 1/5 second and 50 per cent accuracy. The plotting is on logarithmic scale with the log of contrast plotted as the ordinate and the log of brightness (luminance) as the abscissa.**

Lighting." Industrial tasks were evaluated through correlation of the Luckiesh-Moss Visibility Meter and the Weston Method.

In 1950 the Technical Advisory Committee on Light and Vision of the Illuminating Engineering Research Institute decided that a more comprehensive approach to the subject of quantity should be made. It felt that the Landolt ring previously used was too complex a test object to start with to determine the basic parameters of vision. Also, it was felt that the statistical treatment and handling of the results was not as clear as they desired. A "search" around the ring was required to find the opening. They recommended starting with a simple circular disc which would be symmetrical in keeping with the symmetry of the eye. They visualized that later the study of more complex test objects and their relation to the simple basic disc should be carried out.

### Dr. Blackwell's Work

Dr. H. Richard Blackwell, Director of the Vision Research Laboratories, University of Michigan, had been studying basic parameters of visibility for military use since early in World War II. He had excellent facilities and personnel for carrying out this work. The Research Institute initiated the first contract in 1950 and after eight years the results of his studies have now been developed into a system for field use.

Dr. Blackwell's laboratory set-up consisted of a large cubicle painted white and illuminated by concealed lighting from the sides, as shown in Fig. 1. In the center of the cubicle there appeared at the appropriate time a test-spot projected from the rear onto the translucent screen forming part of the wall. The test-spot was projected during one of four possible time intervals which were delineated by a buzzer-sound at the beginning of each interval. There were four tiny orientation lights denoting that the disc would appear in the middle of them. The observer had to press one of four buttons at the interval when the disc appeared. Dr. Blackwell varied the size, contrast, and time of viewing the disc as the brightness of the whole cubicle was raised. The size varied from 1 minute to 64 minutes, contrast from .01 to 300, time from 1 second to .001 second, and background brightness (cubicle) from .001 to 800 footlamberts.

**Figure 3. A study of the factor between static laboratory conditions where the observer knew just when and where the object would appear and the usual dynamic eye-movement conditions in performing work tasks. The wheel simulates a field operation where the eye must scan the detail to be seen, such as reading or working on conveyor belt tasks.**

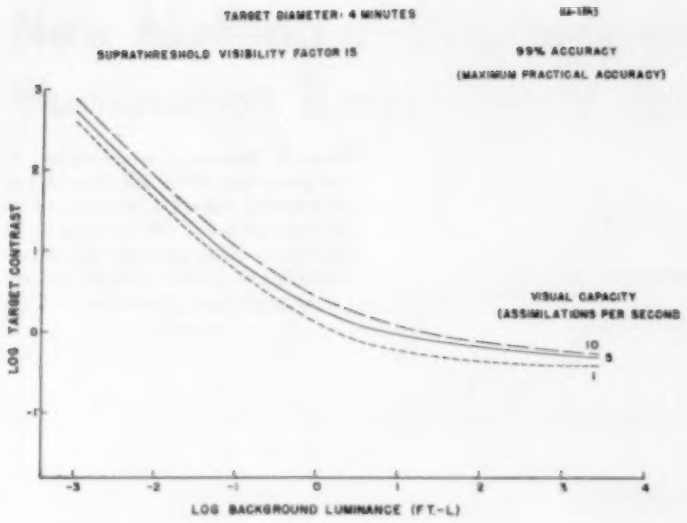



**Figure 4. Applying the factor of 15 in contrast as found in Fig. 3 to data of Fig. 2, the results are shown here for three time factors (assimilations per second) and 99 per cent accuracy.**

While the resulting data is extensive, the immediately useful data for lighting application is illustrated in Fig. 2.

Most field tasks have sizes between 1 minute and 10 minutes and the time pause for the unhurried eye in scanning common tasks is approximately $^1/_5$ second. Of course, not many people are interested in seeing a task with "50 per cent accuracy" (50 per cent of the time it is exposed) but this is the condition for which the most accurate laboratory results can be obtained statistically. In general the multiplying factor between 50 per cent accuracy and 99 per cent accuracy is 2 in contrast.

The family of curves in Fig. 2 is the result of visual performance under laboratory conditions where vision is static and one looks fixedly at the place where the object will appear. Through the audible signals and the fixation or orientation lights, one knows just when and where the task will appear. What happens when one goes into the field and the eyes are constantly moving and one may not know when and where the task will appear? Dr. Blackwell set up an experiment to determine this factor.

**Figure 5. Visual Task Evaluator that reduces contrast of unknown field task to threshold and equates it to a 4-minute circular disc.**

An 8-foot wheel was constructed with 50 four-inch plastic discs on the perimeter (as shown in Fig. 3). As the wheel revolves there is the equivalent action of a conveyor belt. Among the 50 discs there are 3 to 6 discs which have circular defects in the center. The act of seeing probably starts by catching sight of the defect out of the corner of the eye, then a fixation, and then an automatic follow-through to punching the register button opposite the defect, the latter probably being done without visual guidance. Six discs are visible in the booth at all times.

The results of this study showed that the difference between a static laboratory condition and a dynamic "moving-eye" field-condition is a factor of 15, not in footcandles but in contrast.* To see a circular disc in the field as contrasted with the laboratory, one would need the light necessary for that same size test object with a contrast $^1/_{15}$ of that of the static laboratory task. The results of applying this factor and considering three time intervals are shown in Fig. 4.

The three time intervals in Fig. 4 are presented from a different viewpoint and are called "assimilations per second." If the eye can see a given test-object or bit of information in $^1/_5$ second, it has the capacity of assimilating five bits of information in one second. This is the concept of "visual capacity"

*The factor of 15 also takes account of the difference between laboratory criteria of seeing and the "common sense" seeing of actual practice.

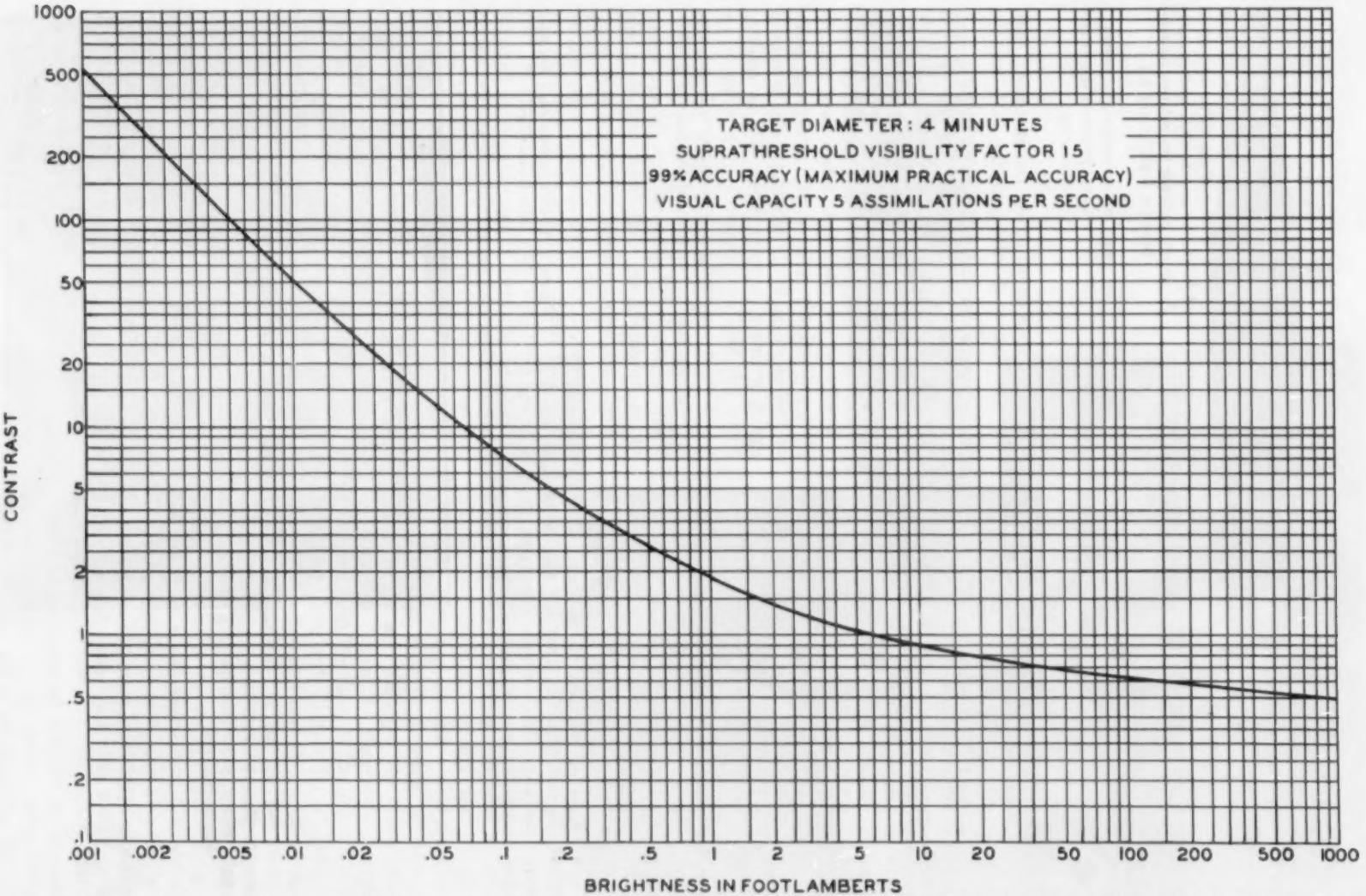



**Figure 6. Field Use Curve. All unknown field tasks may be related by the Visual Task Evaluator to this curve of a 4-minute circular disc which has been weighted to represent "moving-eyes" field conditions and maximum field accuracy.**

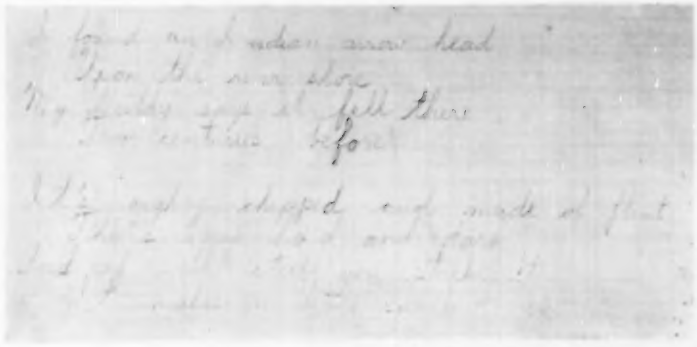


**Figure 7. Average of poorer contrast No. 2 pencil handwriting samples of 31 6th grade pupils requires 63 footcandles illumination. (The limitations of halftone reproduction, unfortunately, do not indicate the relative contrast between Figs. 7 and 8.)**

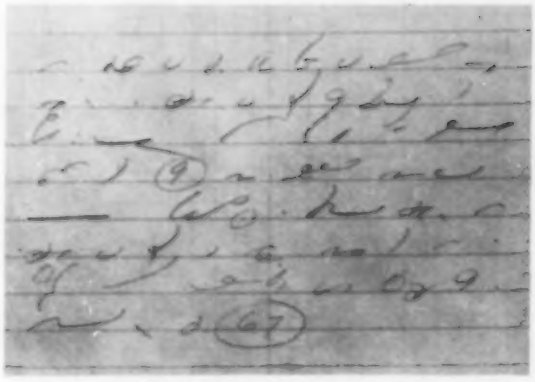


**Figure 8. Stenographic writing with No. 3 pencil requires 76 footcandles.**

which has been advanced by Dr. Blackwell, with the consultation of others, as the basis for the structure of illumination recommendations.

One assimilation per second means that the eyes take one full second to see the task, and 10 APS means that the eyes take only $^1/_{10}$ second to see the task and therefore have the capacity to carry out 10 such tasks per second.

Studies of eye movements which have been recorded electrically indicate an approximate pause of fixation of $^1/_4$ to $^1/_5$ second for the unhurried eye in ordinary scanning tasks such as reading. Since this has been measured by a series of researchers, it was thought well-supported and conservative to use for the present the base of 5 APS. There are studies which show that the eye speeds up in accomplishing work tasks, and there are

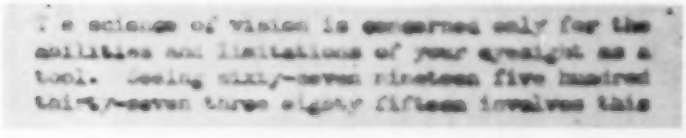


**Figure 9. Fourth carbon copy requires 133 footcandles.**

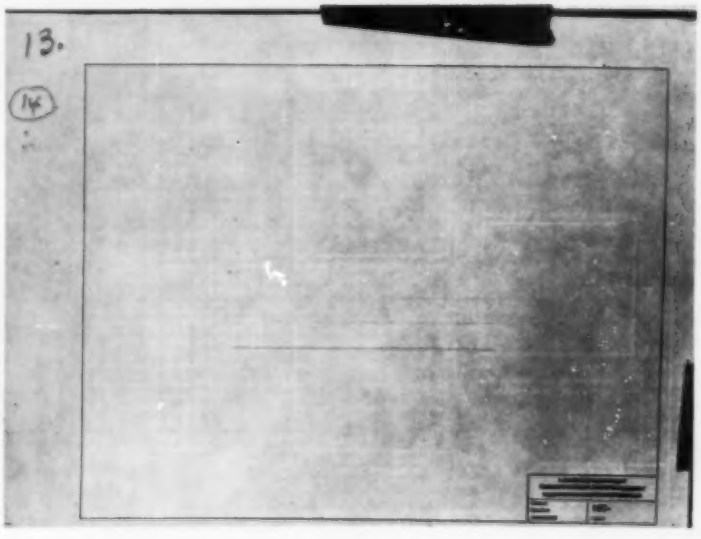


**Figure 10. Blueprint white lines through tracing paper require 400 footcandles.**

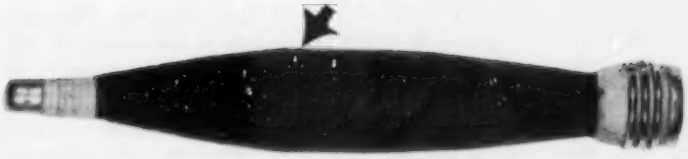


**Figure 11. Broken black wool thread is seen by slight highlight and shadow effect on spinner bobbin and requires 2900 footcandles.**

**Figure 12. Defects in piece of redwood lumber require 71 to 381 footcandles.**

**Figure 13. Proofed type requires broad area highlight reflected in surfaces from over 3000-footlambert source.**

**Figure 14. Spot on gray cloth requires 1100 footcandles.**

evidences that it would be reasonable to use 10 APS. More information is needed, however, to establish such ability or capacity both from the viewpoint of reception during eye movements and the response of the brain.

Until now, the only details to be seen are circular discs because all the laboratory data are on this test-object. How does one go from a circular configuration to an unknown configuration found in commerce and industry? Dr. Blackwell overcame this step by developing a Visual Task Evaluator, shown in Fig. 5. This instrument is constructed on the principle of reducing the contrast of the unknown configuration by placing over it a veiling brightness which, as it is increased, begins to "wash" out the details and brings the configuration to threshold of being seen. After this is done, another set of optics swings into place and a circular disc of 4-minute visual size is reduced to threshold under the same conditions of viewing as the unknown task. At this point the unknown is equal in visibility to the 4-minute disc of the resulting contrast. The "gap has been bridged" and one can find by using Fig. 6* (4-minute curve) the brightness necessary to see both the 4-minute disc under dynamic field conditions and, of course, the unknown task which is its equivalent.

The application committees (Office, School, Store, Industrial, etc.) sent in 56 tasks representative of their fields. These were measured by Dr. Blackwell's staff aided by several I.E.S. field engineers.

The Joint Task Committee on School Lighting, consisting of representatives of the American Institute of Architects, the National Council for Schoolhouse Construction and the Illuminating Engineering Society, decided several years ago that pencil writing with No. 2 pencil on matte white paper would be considered the commonly-found more difficult task in the classroom. Accordingly, Chairman John Chorlton, of the Toronto Board of Education, obtained 31 samples of handwriting from 6th Graders and sent them to Dr. Blackwell. Of the 31 samples 12 (or 40 per cent) were grouped together toward the lower range of visibility, because of poorer contrast. The average indicated the need for 63 footcandles for 5 APS. See Fig. 7 for the average sample handwriting.

The office secretary often uses a No. 3 pencil for long dictation periods to avoid frequent sharpening of a supply of softer ones. The sample in Fig. 8 required 76 footcandles.

The original copy of a typed letter usually is sharp and bold, but the fourth carbon copy was found to require 133 footcandles (Fig. 9).

*More useful plot of Fig. 4.

A pencil line on tracing paper requires little light as compared with the white lines of the blueprint showing through tracing paper (Fig. 10) which in the sample measured were found to require 400 footcandles.

The garment industry is concerned with the economy of its precision cutting. With many dark patterns it is easy to see the chalkmarks. The tricky ones are those lighter patterns which blend with the chalkmarks. For instance, for a brown tweed with an orange chalkmark, it takes 266 footcandles to see the markings.

In textile mill tasks, it was found that a broken-black thread on a spinner-bobbin required 2900 footcandles (Fig. 11). The broken end is scuffed loose by the operator and then is seen by slight shadow and highlight effect against the rest of the thread on the bobbin.

Lumber defects as seen by the grader vary greatly in the amount of light required. The light required to detect the defects in the sample of redwood lumber shown in Fig. 12 varies from 71 to 381 footcandles.

Proofed type requires a bright source reflected in its surface to be seen. Measurements indicated the need for more than 3000 footlamberts in a broad area highlight (Fig. 13). On the same principle, vernier calipers need 630 footlamberts.

Spots and stains sometimes are hard to see. In Fig. 14, a brown stain on gray cloth required 1100 footcandles, a brown spot on a red necktie required 2400 footcandles.

These are merely a few examples of those taken from commerce and industry to aid the I.E.S. application committees in arriving at illumination recommendations based upon the new Blackwell method of Determining Illumination Required for Visual Tasks.

## Report No. 1 of I.E.S. Committee on

# Recommendations for Quality and Quantity of Illumination

A NEW system of determining illumination level recommendations has been presented to the Society by the Illuminating Engineering Research Institute.

The method results in the establishment for a quantity of practical seeing tasks of a series of four-minute standard test objects of equivalent degrees of contrast. These equivalent values all lie on a curve relating required task brightness to the contrast value corresponding to the following conditions:

A. Visual capacity of five assimilations per second (APS),
B. 99 per cent accuracy (maximum practical accuracy),
C. Suprathreshold visibility factor of 15.

For purposes of use by the technical committees of the Society, the values of equivalent contrast have been divided into five categories representing five general levels of task difficulty. The first category represents contrast values which require task brightness values of less than 18 footlamberts. The range of contrast values requiring more than 18 footlamberts was divided into four equal categories in terms of contrast values. The task designations arbitrarily selected to describe these tasks, and the range of corresponding brightness values are shown in Table I.

The 56 practical visual tasks actually studied are listed in Table II in terms of the task difficulty ob-

TABLE I.

| Category of Seeing Task | Guide Brightness in Footlamberts |
|---|---|
| Most difficult | 420 up |
| Very difficult | 120-420 |
| Difficult | 42-120 |
| Ordinary | 18-42 |
| Easy | below 18 |

NOTE: Footcandles will depend upon the reflectance of the task. Tasks having lower reflectances will require much higher footcandle levels. For example:

| | 60% Reflectance | 6% Reflectance |
|---|---|---|
| Most difficult | 700 fc | 7000 fc |
| Very difficult | 200-700 fc | 2000-7000 fc |
| Difficult | 70-200 fc | 700-2000 fc |
| Ordinary | 30-70 fc | 300-700 fc |
| Easy | 30 fc and below | 300 fc and below |

Approved by the Council of the Illuminating Engineering Society, June 1958. A Transaction of the Society.

**TABLE II — Classification of 56 Practical Tasks.**

| Task No. | Task Description | Required Brightness Footlamberts | Reflectance | Required Illumination Footcandles |
|---|---|---|---|---|
| | **A. EASY TASKS** | | | |
| (23) | Light stitching on blue serge cloth: Vertical stitching | .09 | .018 | 5.05 |
| (15) | White chalk mark on blue serge cloth | .20 | .020 | 10.4 |
| (16) | Dot defects on dark blue cloth | .30 | .017 | 17.8 |
| (12) | Dark blue mimeograph stencil, with clear plastic overlay | .39 | .11 | 3.54 |
| (7) | 12-point textype | .42 | .70 | .60 |
| (9) | Typed original, good ribbon | .60 | .62 | .97 |
| (6) | 10-point textype | .66 | .70 | .94 |
| (17) | Gray line defect on black cloth | .66 | .024 | 27.5 |
| (5) | 8-point textype | .79 | .70 | 1.13 |
| (33) | Broken black thread on spinner bobbin, 30 degrees illumination | .93 | .079 | 11.8 |
| (1) | Sample of ink writing, one 6th grade student | 1.05 | .76 | 1.38 |
| (3) | 8-point Bodoni type | 1.31 | .70 | 1.87 |
| (4) | 6-point Bodoni type | 2.08 | .70 | 2.98 |
| (30) | Price tag, ink | 2.36 | .76 | 3.10 |
| (36) | Tight sound edge knot, viewed from 16 feet | 2.46 | .19 | 12.9 |
| (14) | No. 2 pencil on tracing paper over blueprint | 3.88 | .59 | 6.58 |
| (31) | Broken white wool thread on spinner bobbin | 4.17 | .66 | 6.32 |
| (22) | White chalk on gray cloth | 6.92 | .33 | 21.0 |
| (24) | Pattern threads, men's silk and wool suiting | 7.24 | .22 | 32.9 |
| (18) | Darned blemish on gray cloth | 7.41 | .10 | 74.1 |
| (47) | New micrometer, etched | 7.41 | (specular) | |
| (27) | Pattern threads, white handkerchief | 8.97 | .91 | 9.86 |
| (35) | Skip defect, viewed from 16 feet | 13.5 | .19 | 71. |
| | **B. ORDINARY TASKS** | | | |
| (41) | Small skip defect, viewed from 30 inches | 35.6 | .19 | 187. |
| | **C. DIFFICULT TASKS** | | | |
| (2) | Samples of No. 2 pencil writing, twelve 6th grade students with poorest writing in class of 31 | 47.8 | .76 | 63. |
| (21) | Orange chalk on light brown tweed | 47.9 | .18 | 266. |
| (32) | Broken black thread on spinner bobbin, 30 degrees illumination | 52.5 | .018 | 2920. |
| (25) | Dark brown raised threads on silk | 58.9 | .035 | 1680. |
| (40) | Small seasoning check, viewed from 30 inches | 60.3 | .19 | 317. |
| (8) | Sample of shorthand copy with No. 3 pencil | 60.5 | .79 | 76.5 |
| (11) | Typed carbon, fifth copy | 70.7 | .53 | 133. |
| (37) | Bark wave, viewed from 16 feet | 72.4 | .19 | 381. |
| (43) | Brown color difference in cloth | 100. | .12 | 870. |
| | **D. VERY DIFFICULT TASKS** | | | |
| (48) | Old micrometer, specular on numbers | 148. | (specular) | |
| (29) | Price tag, pencil | 151. | .63 | 241. |
| (42) | Chip grain, viewed from 30 inches, no specular | 195. | .19 | 1030. |
| (13) | Thermofax copy, poor quality | 371. | .63 | 589. |
| (34) | Broken white nylon thread on spinner bobbin, 30 degrees illumination | 380. | .78 | 487. |
| | **E. MOST DIFFICULT TASKS** | | | |
| (26) | Blue-gray raised threads on silk | 447. | .046 | 9650. |
| (45) | Unproofed type | 447. | (specular) | |
| (46) | Vernier calipers, non-etched | 631. | (specular) | |
| (28) | Pocket stitching, tan skirt | 1000. | .53 | 1890. |
| (39) | Chip grain, viewed from 16 feet | 1230. | .19 | 6470. |
| (10) | Typed original, extremely poor ribbon | 1950. | .62 | 3140. |
| (19) | Brown stitching on brown silk, vertical stitching | >3000. | .12 | >10,000. |
| (20) | Gray stitching on gray silk, horizontal stitching | >3000. | .76 | >10,000. |
| (38) | Small decay spot, viewed from 16 feet | >3000. | .19 | >10,000. |
| (44) | Proofed type | >3000. | (specular) | |
| (49) | White line on blueprint, tracing paper overlay | >3000. | .59 | 5090. |
| (50) | Brown thread stitching on brown silk tweed | >3000. | .12 | >10,000. |
| (51) | White chalk on tan cloth | >3000. | .24 | >10,000. |
| (52) | Rolled-edge defect on white handkerchief | >3000. | .91 | 3300. |
| (53) | Seasoning check, viewed at 16 feet | >3000. | .19 | >10,000. |
| (54) | Brown stain on gray cloth | >3000. | .12 | >10,000. |
| (55) | Brown spot on red necktie | >3000. | .84 | >10,000. |
| (56) | Brown spot on tan necktie | >3000. | .176 | >10,000. |

tained by actual measurement and serve as a basis for the classification of unrated tasks.

**Instructions for Use of Data**

(1) In any given location the seeing tasks should first be studied to determine if more than one is involved. Where a combination of tasks of varying degrees of severity is encountered, select the one that is the commonly used, most difficult task.

(2) From Table II find tasks that are most nearly comparable to the unrated task and select the corresponding brightness in footlamberts.

(3) Divide this brightness by the average reflectance of the unrated task to determine the range of footcandles.

(4) In establishing the recommended illumination value, engineering judgment based on economic factors should be considered.

(5) In all locations involving visual tasks, levels of less than 30 footcandles do not appear desirable. Data on oculomotor adjustment functions, although incomplete, suggest that for the eyes to focus sharply and the two eyes to converge accurately upon detail, it is necessary to have a minimum degree of brightness (or footcandles). In addition, considerations of maintaining adaptation between one task and another for efficient seeing suggest that a lower limit of brightness (or footcandles) should be placed on the less demanding tasks to coordinate the environmental conditions for optimum visual performance in a given location in commerce, industry or the home.

(6) Consistence of illumination values should be checked.

(7) In selecting an illumination value, it is recommended that it be fitted into the following sequential order:

10, 15, 20, 30, 50, 70 and 100

× 0.1
× 1.
× 10.
× 100.
× 1000.

} as required.

(8) In determining illumination values for service areas, it is recommended that such be not less than one-fifth that in adjacent areas. Each committee should decide specific values for such areas in relation to the adjacent area illumination to be encountered in their particular field. In no case should such illumination be less than 10 footcandles. Included in service areas are the following:

Elevators
Lobbies
Hallways
Storage
Washrooms
Stairs and landings

**TABLE III.**

| Office Tasks | Currently Recommended Illumination* Footcandles |
|---|---|
| Cartography, designing, detailed drafting | 200 |
| Accounting, auditing, tabulating, bookkeeping, reading poor reproductions, rough layout drafting | 150 |
| Regular office work, reading good reproductions, reading or transcribing handwriting in hard pencil or on poor paper, active filing, index references, mail sorting | 100 |
| Reading or transcribing handwriting in ink or medium pencil on good quality paper, intermittent filing | 70 |
| Reading high contrast or well-printed material tasks and areas not involving critical or prolonged seeing such as conferring, interviewing, inactive files and washrooms | 30 |
| Corridors, elevators, escalators, stairways | 20** |

*Minimum on the task at any time.
**Or not less than one-fifth level in adjacent areas.

(9) While most seeing tasks fit into categories that fall naturally under the scopes of the various technical committees, there are a few borderline cases which it is recommended be undertaken by the following committees:

| Task | Committee |
|---|---|
| Armories | School |
| Art Galleries | Institutions |
| Auditoriums (other than theater) | School |
| Automobiles (showrooms) | Store |
| Banks | Office |
| Churches | Institutions |
| Club and Lodge Rooms | Institutions |
| Court Rooms | Institutions |
| Dance Halls | Sports and Recreational |
| Depots, Terminals and Stations | Office |
| Drafting Rooms | Office |
| Libraries | School |
| Municipal Buildings (Fire and Police) | Office |
| Museums | Institutions |
| Post Offices | Office |
| Professional Offices | Institutions |

**Illustrations of Method**

In Table III is shown a suggested table of office lighting tasks determined on the above described basis and included as a guide.

Respectfully submitted,

I.E.S. COMMITTEE ON RECOMMENDATIONS OF QUALITY AND QUANTITY OF ILLUMINATION

B. S. Benson, Jr., *Chairman*

| | |
|---|---|
| Willard Allphin | L. V. James |
| E. Boghosian | W. H. Kahler |
| J. M. Chorlton | F. J. Marriett |
| G. F. Dean | D. W. Rowten |
| Lester Geis | E. M. Strong |
| J. W. Griffith | M. A. Warskow |
| S. K. Guth | W. W. Weld |

# New Footcandle Tables

SINCE eleven members of the Committee on Recommendations for Quality and Quantity of Illumination are also chairmen of the major application committees, they were in a position to implement the recommendations of Report No. 1 and to furnish information and leadership toward the development by each committee of suitable illumination recommendations. Immediately upon the presentation of the Blackwell research data and the development of the R.Q.Q. Report as a guide, they called their various committees together. These committees studied the field tasks evaluated by Blackwell and attempted to develop a list of recommended values for the various categories found in their field. Many times there were no tasks measured by Blackwell which applied to their activity. However, by weighing the relative difficulty of the tasks that were measured and comparing them with those that they had at hand, they arrived at recommended levels. These levels were then balloted upon by the members of each application committee and upon majority approval were submitted to Council.

The Technical Office of I.E.S. aided in correlation of values for similar locations in the different fields. Further refinements in correlation and consistency are possible as these listings are studied by the technical committees in development of revisions of Recommended Practices and by members of the Society and readers of ILLUMINATING ENGINEERING. All recommended levels are the result of an interpretation of the Blackwell data and a weighting by pooled committee experience of the range of tasks found in the field and the range of values obtained by Blackwell on the various samples submitted, as well as the ability, practically, to produce the levels contemplated. Naturally experience and judgment vary and some would have interpreted the information in terms of higher footcandle recommendations, and some lower.

It is anticipated that these new recommendations will find a range of response in field use, with some feeling them too high, and others accepting them as basic to the need as indicated in the Blackwell evaluations. As has occurred many times in the past when new levels were introduced, it is expected that they will be widely accepted after a little time, because they meet the real needs of seeing in commerce, industry and the home.

## INDUSTRIAL AREAS

(Notes for this section are on page 428)

| | Currently Recommended Illumination* Footcandles |
|---|---|
| **AIRPLANE MANUFACTURING** | |
| Stock parts | |
| Production | 100 |
| Inspection | 200** |
| Parts manufacturing | |
| Drilling, riveting and screw fastening | 70 |
| Spray booths | 100 |
| Sheet aluminum layout and template work; shaping and smoothing of small parts for fuselage; wing sections, cowling, etc. | 100 |
| Welding | |
| General illumination | 50 |
| Supplementary illumination | 1000 |
| Subassembly | |
| Landing gear, fuselage, wing sections, cowling and other large units | 100 |
| Final assembly | |
| Placing of motors, propellers, wing sections and landing gear | 100 |
| Inspection of assembled ship and its equipment | 100 |
| Machine tool repairs | 100 |
| **AIRPLANE HANGARS** | |
| Repair service only | 100 |
| **ASSEMBLY** | |
| Rough easy seeing | 30 |
| Rough difficult seeing | 50 |
| Medium | 100 |
| Fine | 500 |
| Extra Fine | 1000 |
| **AUTOMOBILE MANUFACTURING** | |
| Frame assembly | 50 |
| Chassis assembly line | 100 |
| Final assembly and inspection line | 200** |
| Body manufacturing | |
| Parts | 70 |
| Assembly | 100 |
| Finishing and inspecting | 200** |
| **BAKERIES** | |
| Mixing room | 50 |
| Face of shelves (vertical illumination) | 30 |
| Inside of mixing bowl (vertical mixers) | 50 |
| Fermentation room | 30 |
| Make-up room | |
| Bread | 30 |
| Sweet yeast raised products | 50 |
| Proofing Room | 30 |
| Oven room | 30 |
| Fillings and other ingredients | 50 |
| Decorating and icing | |
| Mechanical | 50 |
| Hand | 100 |
| Scales and thermometers | 50 |
| Wrapping room | 30 |

| | Currently Recommended Illumination* Footcandles |
|---|---|
| **BOOK BINDING** | |
| Folding, assembling, pasting, etc. | 70 |
| Cutting, punching and stitching | 70 |
| Embossing and inspection | 200** |
| **BREWERIES** | |
| Brew house | 30 |
| Boiling and keg washing | 30 |
| Filling (bottles, cans, kegs) | 50 |
| **CANDY MAKING** | |
| Box department | 50 |
| Chocolate department | |
| Husking, winnowing, fat extraction, crushing and refining, feeding | 50 |
| Bean cleaning and sorting, dipping, packing, wrapping | 50 |
| Milling | 100 |
| Cream making | |
| Mixing, cooking and molding | 50 |
| Gum drops and jellied forms | 50 |
| Hand decorating | 100 |
| Hard candy | |
| Mixing, cooking and molding | 50 |
| Die cutting and sorting | 100 |
| Kiss making and wrapping | 100 |
| **CANNING AND PRESERVING** | |
| Initial grading raw material samples | 50 |
| Tomatoes | 100 |
| Color grading (cutting rooms) | 200** |
| Preparation | |
| Preliminary sorting | |
| Apricots and peaches | 50 |
| Tomatoes | 100 |
| Olives | 150 |
| Cutting and pitting | 100 |
| Final sorting | 100 |
| Canning | |
| Continuous belt canning | 100 |
| Sink canning | 100 |
| Hand packing | 50 |
| Olives | 100 |
| Examination of canned samples | 200** |
| Container handling | |
| Inspection | 200** |
| Can unscramblers | 70 |
| Labeling and cartoning | 30 |
| **CENTRAL STATION INDOOR LOCATIONS** | |
| Air-conditioning equipment, air preheater and fan floor, ash sluicing | 10 |
| Auxiliaries, battery rooms, boiler feed pumps tanks, compressors and gauge area | 20 |
| Boiler platforms | 10 |
| Burner platform | 20 |
| Cable room, circulator or pump bay | 10 |
| Coal conveyor, crusher, feeder, scale areas, pulverizer, fan area, transfer tower | 10 |
| Condensers, deaerator floor, evaporator floor and heater floors | 10 |
| Control rooms | |
| Vertical face of switchboards | |
| Simplex or section of duplex facing operator, | |
| Type A — Large centralized control room 66 inches above floor | 50 |
| Type B — Ordinary control rooms at 66 inches above floor | 30 |
| Section of duplex facing away from operator | 30 |
| Bench boards (horizontal level) | 50 |
| Area inside duplex switchboards | 10 |
| Rear of all switchboard panels (vertical) | 10 |
| Emergency lighting, all areas | 3 |
| Hydrogen and carbon dioxide manifold area | 20 |
| Chemical laboratory | 50 |
| Precipitators | 10 |
| Screen house | 20 |
| Soot or slag blower platform | 10 |
| Steam headers and throttles | 10 |
| Switchgear power | 20 |
| Telephone equipment room | 20 |
| Tunnels or galleries, piping | 10 |
| Turbine bay sub-basement | 20 |
| Turbine room | 30 |
| Visitor's gallery | 20 |
| Water treating area | 20 |
| **CENTRAL STATION OUTDOOR LOCATIONS** | |
| Catwalks | 2.0 |
| Cinder dumps | 0.1 |
| Coal unloading | |
| (a) Dock (loading or unloading zone) | 5.0 |
| (b) Barge storage area | 0.5 |
| (c) Car dumper | 0.5** |
| (d) Tipple | 5.0 |
| Coal storage area | 0.1 |
| Conveyors | 2.0 |
| Entrances | |
| Generating or service building | |
| (a) Main | 10.0 |
| (b) Secondary | 2.0 |
| Gate house | |
| (a) Pedestrian entrance | 10.0 |
| (b) Conveyor entrance | 5.0* |
| Fence | 0.2 |
| Fuel oil delivery headers | 5.0 |
| Oil storage tanks | 1.0 |
| Open yard | 0.2 |
| Platforms — boiler, turbine deck | 5.0 |
| Roadway | |
| (a) Between or along buildings | 1.0 |
| (b) Not bordered by buildings | 0.5 |
| Substation | |
| (a) General horizontal | 2.0 |
| (b) Specific vertical (on disconnects) | 2.0 |
| **CHEMICAL WORKS** | |
| Hand furnaces, boiling tanks, stationary driers, stationary and gravity crystallizers | 30 |
| Mechanical furnaces, generators and stills, mechanical driers, evaporators, filtration, mechanical crystallizers, bleaching | 30 |
| Tanks for cooking, extractors, percolators, nitrators, electrolytic cells | 30 |
| **CLAY PRODUCTS AND CEMENTS** | |
| Grinding, filter presses, kiln rooms | 30 |
| Molding, pressing, cleaning and trimming | 30 |
| Enameling | 100 |
| Color and glazing — rough work | 100 |
| Color and glazing — fine work | 300** |
| **CLEANING AND PRESSING INDUSTRY** | |
| Checking and sorting | 50 |
| Dry and wet cleaning and steaming | 50 |
| Inspection and spotting | 500** |
| Pressing | |
| Machine | 150 |
| Hand | 150 |
| Repair and alteration | 200** |
| **CLOTH PRODUCTS** | |
| Cloth inspection | 2000** |
| Cutting | 300** |
| Sewing | 500** |
| Pressing | 300** |
| **COAL TIPPLES AND CLEANING PLANTS** | |
| Breaking, screening and cleaning areas | 10 |
| Picking | 300** |
| **DAIRY PRODUCTS** | |
| Fluid milk industry | |
| Boiler room | 30 |
| Bottle storage | 30 |
| Bottle sorting | 50 |
| Bottle washers | †† |
| Can washers | 30 |
| Cooling equipment | 30 |
| Filling: inspection | 100 |
| Gages (on face) | 50 |
| Laboratories | 100 |
| Meter panels (on face) | 50 |
| Pasteurizers | 30 |
| Separators | 30 |
| Storage refrigerator | 30 |
| Tanks, vats | |
| Light interiors | 20 |
| Dark interiors | 100 |
| Thermometer (on face) | 50 |
| Weighing room | 30 |
| Scales | 70 |
| **ELECTRICAL EQUIPMENT MANUFACTURING** | |
| Impregnating | 50 |
| Insulating: coil winding | 100 |
| Testing | 100 |
| **EXPLOSIVES** | |
| Hand furnaces, boiling tanks, stationary driers, stationary and gravity crystallizers | 30 |

| | Currently Recommended Illumination* Footcandles |
|---|---|
| **EXPLOSIVES (continued)** | |
| Mechanical furnaces, generators and stills, mechanical driers, evaporators, filtration, mechanical crystallizers | 30 |
| Tanks for cooking, extractors, percolators, nitrators | 30 |
| **EXTERIOR AREAS** | |
| Entrances | |
| Active (pedestrian and/or conveyance) | 5.0 |
| Inactive (normally locked, infrequently used) | 1.0 |
| Vital locations or structures | 5.0 |
| Building surrounds | 1.0 |
| Active shipping area surrounds | 5.0 |
| Storage areas — active | 20 |
| Storage areas — inactive | 1 |
| Loading and unloading platforms | 20 |
| **FLOUR MILLS** | |
| Rolling | 50 |
| Sifting | 50 |
| Purifying | 50 |
| Packing | 30 |
| Product control | 100 |
| Cleaning screens, man lifts, aisleways and walkways, bin checking | 30 |
| **FORGE SHOPS** | 50 |
| **FOUNDRIES** | |
| Annealing (furnaces) | 30 |
| Cleaning | 30 |
| Core making (fine) | 100 |
| Core making (medium) | 50 |
| Grinding and chipping | 100** |
| Inspection (fine) | 500** |
| Inspection (medium) | 100 |
| Moulding (medium) | 100 |
| Moulding (large) | 50 |
| Pouring | 50 |
| Sorting | 50 |
| Cupola | 20 |
| Shakeout | 30 |
| **GARAGES — AUTOMOBILE AND TRUCK** | |
| Service garages | |
| Repairs | 100 |
| Active traffic areas | 20 |
| Parking garages | |
| Entrance | 50 |
| Traffic lanes | 10 |
| Storage | 5 |
| **GLASS WORKS** | |
| Mix and furnace rooms, pressing and lehr, glass blowing machines | 30 |
| Grinding, cutting glass to size, silvering | 50 |
| Fine grinding, polishing, beveling | 100 |
| Inspection, etching and decorating | 200** |
| **GLOVE MANUFACTURING** | |
| Pressing | 300** |
| Knitting | 100 |
| Sorting | 100 |
| Cutting | 300** |
| Sewing and inspection | 500** |
| **HAT MANUFACTURING** | |
| Dyeing, stiffening, braiding, cleaning and refining | 100 |
| Forming, sizing, pouncing, flanging, finishing and ironing | 200** |
| Sewing | 500** |
| **INSPECTION** | |
| Ordinary | 50 |
| Difficult | 100 |
| Highly difficult | 200** |
| Very difficult | 500** |
| Most difficult | 1000** |
| **IRON AND STEEL MANUFACTURING** | |
| Open hearth | |
| Stock yard | 10 |
| Charging floor | 20 |
| Pouring slide | |
| Slag pits | 20 |
| Control platforms | 30 |
| Mold yard | 5 |
| Hot top | 30 |
| Hot top storage | 10 |
| Checker cellar | 10 |
| Buggy and door repair | 30 |
| Stripping yard | 20 |
| Scrap stockyard | 10 |
| Mixer building | 30 |
| Calcining building | 10 |
| Skull cracker | 10 |
| Cinder dump | 0.1 |
| Rolling mills | |
| Blooming, slabbing, hot strip, hot sheet | 30 |
| Cold strip, plate | 30 |
| Pipe, rod, tube, wire drawing | 50 |
| Merchant and sheared plate | 30 |
| Tin plate mills | |
| Tinning and galvanizing | 50 |
| Cold strip rolling | 50 |
| Motor room, machine room | 30 |
| Inspection | |
| Blackplate, bloom, billet chipping | 100 |
| Tinplate, other bright surfaces | 100† |
| **LAUNDRIES** | |
| Washing | 30 |
| Flatwork ironing, weighing, listing and marking | 50 |
| Machine and press finishing, sorting | 70 |
| Fine hand ironing | 100 |
| **LEATHER MANUFACTURING** | |
| Cleaning, tanning and stretching, vats | 30 |
| Cutting, fleshing and stuffing | 50 |
| Finishing and scarfing | 100 |
| **LEATHER WORKING** | |
| Pressing, winding and glazing | 200 |
| Grading, matching, cutting, scarfing, sewing | 300 |
| **LOCKER ROOMS** | 20 |
| **MACHINE SHOPS** | |
| Rough bench and machine work | 50 |
| Medium bench and machine work, ordinary automatic machines, rough grinding, medium buffing and polishing | 100 |
| Fine bench and machine work, fine automatic machines, medium grinding, fine buffing and polishing | 500** |
| Extra fine bench and machine work, grinding — fine work | 1000** |
| **MATERIALS HANDLING** | |
| Wrapping, packing, labeling | 50 |
| Picking stock, classifying | 30 |
| Loading, trucking | 20 |
| Inside truck bodies and freight cars | 10 |
| **MEAT PACKING** | |
| Slaughtering | 30 |
| Cleaning, cutting, cooking, grinding, canning, packing | 100 |
| **PACKING AND BOXING (SEE MATERIALS HANDLING)** | |
| **PAINT MANUFACTURING** | |
| General | 30 |
| Comparing mix and standard (see Color Matching) | 200† |
| **PAINT SHOPS** | |
| Dipping, simple spraying, firing | 50 |
| Rubbing, ordinary hand painting and finishing art, stencil and special spraying | 50 |
| Fine hand painting and finishing | 100 |
| Extra fine hand painting and finishing (automobile bodies, piano cases, etc.) | 300** |
| **PAPER BOX MANUFACTURING** | |
| General manufacturing area | 50 |
| **PAPER MANUFACTURING** | |
| Beaters, grinding, calendering | 30 |
| Finishing, cutting, trimming, paper-making machines | 50 |
| Hand counting, wet end of paper machine | 70 |
| Paper machine reel, paper inspection and laboratories | 100 |
| Rewinder | 150 |
| **PLATING** | 30 |
| **POLISHING AND BURNISHING** | 100 |
| **PRINTING INDUSTRIES** | |
| Type foundries | |
| Matrix making, dressing type | 100 |
| Font assembly — sorting | 50 |
| Hand casting | 50 |
| Machine casting | 50 |
| Printing plants | |
| Color inspection and appraisal | 200** |
| Machine composition | 100 |
| Composing room | 100 |
| Presses | 70 |

| | Currently Recommended Illumination* Footcandles |
|---|---|
| PRINTING INDUSTRY (continued) | |
| Imposing stones | 150 |
| Proof reading | 150 |
| Electrotyping | |
| Molding, finishing, leveling molds, routing, trimming | 100 |
| Blocking, tinning | 50 |
| Electroplating, washing, backing | 50 |
| Photo engraving | |
| Etching, staging | 50 |
| Blocking | 50 |
| Routing, finishing, proofing | 100 |
| Tint laying | 100 |
| Masking | 100 |
| RECEIVING AND SHIPPING (SEE MATERIALS HANDLING) | |
| RUBBER TIRE AND TUBE MANUFACTURING | |
| Stock preparation | |
| Banbury, plasticating, milling | 30 |
| Calendering | 50 |
| Fabric preparation | |
| Stock cutting, bead building | 50 |
| Tube tubing machines | 50 |
| Tread tubing machines | 50 |
| Tire building | |
| Solid tire | 30 |
| Pneumatic tire | 50 |
| Curing department | |
| Tube curing, casing curing | 70 |
| Final inspection | |
| Tube, casing | 200** |
| Wrapping | 50 |
| RUBBER GOODS — MECHANICAL | |
| Stock preparation | |
| Plasticating, milling, banbury | 30 |
| Calendering | 50 |
| Fabric preparation | |
| Stock cutting, hose looms | 50 |
| Molded products and curing | 50 |
| Extruded products | 50 |
| Inspection | 200** |
| SHEET METAL WORKS | |
| Miscellaneous machines, ordinary bench work | 50 |
| Presses, shears, stamps, spinning, medium bench work | 50 |
| Punches | 50 |
| Tin plate inspection, galvanized | 200†† |
| Scribing | 200†† |
| SHIP YARDS | |
| General | 5 |
| Ways | 10 |
| Fabrication areas | 30 |
| SHOE MANUFACTURING (LEATHER) | |
| Cutting and stitching | |
| Cutting tables | 300** |
| Marking, buttonholing, skiving, sorting, vamping and counting | 300** |
| Stitching | |
| Dark materials | 300** |
| Making and finishing | |
| Nailers, sole layers, welt beaters and scarfers, trimmers, welters, lasters, edge setters, sluggers, randers, wheelers, treers, cleaning, spraying, buffing, polishing, embossing | 200 |
| SHOE MANUFACTURING (RUBBER) | |
| Washing, coating, mill run compounding | 30 |
| Varnishing, vulcanizing, calendering, upper and sole cutting | 50 |
| Sole rolling, lining, making and finishing processes | 100 |
| SOAP MANUFACTURING | |
| Kettle houses, cutting, soap chip and powder | 30 |
| Stamping, wrapping and packing, filling and packing soap powder | 50 |
| STAIRWAYS, WASHROOMS AND OTHER SERVICE AREAS | 20 |
| STONE CRUSHING AND SCREENING | |
| Belt conveyor tubes, main line shafting spaces, chute rooms inside of bins | 10 |
| Primary breaker room, auxiliary breakers under bins | 10 |
| Screens | 20 |
| STORAGE ROOMS OR WAREHOUSES | |
| Inactive | 5 |
| Active | |
| Rough bulky | 10 |
| Medium | 20 |
| Fine | 50 |
| STRUCTURAL STEEL FABRICATION | 50 |
| SUGAR REFINING | |
| Grading | 50 |
| Color inspection | 200 |
| TESTING | |
| General | 50 |
| Extra fine instruments, scales, etc. | 200** |
| TEXTILE MILLS (COTTON) | |
| Opening, mixing, picking | 30 |
| Carding and drawing | 50 |
| Slubbing, roving, spinning and spooling | 50 |
| Beaming and slashing on comb | |
| Grey goods | 50 |
| Denims | 50 |
| Inspection | |
| Grey goods (hand turning) | 100 |
| Denims (rapidly moving) | 500** |
| Automatic tying-in | 150** |
| Drawing-in by hand | 200** |
| Weaving | 100 |
| TEXTILE MILLS (SILK AND SYNTHETICS) | |
| Manufacturing | |
| Soaking, fugitive tinting, and conditioning or setting of twist | 30 |
| Winding, twisting, rewinding, and coning, quilling, slashing | |
| Light thread | 50 |
| Dark thread | 200 |
| Warping (silk or cotton system) on creel, on running ends, on reel, on beam, on warp at beaming | 100 |
| Drawing-in | |
| On heddles | 200** |
| On reed | 200** |
| Weaving | 100 |
| TEXTILE MILLS (WOOLEN AND WORSTED) | |
| Opening, blending, picking | 30 |
| Grading | 100** |
| Carding, combing, recombing, gilling | 50 |
| Drawing (white) | 50 |
| Drawing (colored) | 100 |
| Spinning (frame) (white) | 50 |
| Spinning (frame) (colored) | 100 |
| Spinning (mule) (white) | 50 |
| Spinning (mule) (colored) | 100 |
| Twisting (white) | 50 |
| Winding (white) | 30 |
| Winding (colored) | 50 |
| Warping (white) | 50 |
| Warping (white) (at reed) | 100 |
| Warping (colored) | 100 |
| Warping (colored) (at reed) | 300** |
| Weaving (white) | 100 |
| Weaving (colored) | 200 |

## Notes on Industrial Areas

*Minimum on the task at any time.

**Obtained with a combination of general lighting plus specialized supplementary lighting. Care should be taken to keep within the recommended brightness ratios. These seeing tasks generally involve the discrimination of fine detail for long periods of time and under conditions of poor contrast. To provide the required illumination, a combination of the general lighting indicated plus specialized supplementary lighting is necessary. The design and installation of the combination system must not only provide a sufficient amount of light, but also the proper direction of light, diffusion, and eye protection. As far as possible it should eliminate direct and reflected glare as well as objectionable shadows.

†The specular surface of the material may necessitate special consideration in selection and placement of lighting equipment, or orientation of the work.

††Special lighting such that (1) the luminous area shall be large enough to cover the surface which is being inspected and (2) the brightness be within the limits necessary to obtain comfortable contrast conditions. This involves the use of sources of large area and relatively low brightness in which the source brightness is the principal factor rather than the footcandles produced at a given point.

| TEXTILE MILLS (continued) | Currently Recommended Illumination* Footcandles |
|---|---|
| Grey goods room | |
| Burling | 150** |
| Sewing | 300** |
| Folding | 70 |
| Wet finishing | |
| Fulling | 50 |
| Scouring | 50 |
| Crabbing | 50 |
| Drying | 50 |
| Dyeing | 100** |
| Dry finishing | |
| Napping | 70 |
| Shearing | 100** |
| Conditioning | 70 |
| Pressing | 70 |
| Inspecting (perching) | 2000** |
| Folding | 70 |
| TOBACCO PRODUCTS | |
| Drying, stripping, general | 30 |
| Grading and sorting | 200** |
| UPHOLSTERING — AUTOMOBILE, COACH FURNITURE | 100 |
| WAREHOUSE (see Storage) | |
| WELDING | |
| General illumination | 50 |
| Precision manual arc welding | 1000** |
| WOODWORKING | |
| Rough sawing and bench work | 30 |
| Sizing, planing, rough sanding, medium machine and bench work, glueing, veneering, cooperage | 50 |
| Fine bench and machine work, fine sanding and finishing | 100 |

# INSTITUTIONS

(Notes for this section are on page 430)

| | Currently Recommended Illumination* Footcandles |
|---|---|
| ART GALLERIES | |
| General | 30 |
| On paintings (supplementary) | 30 |
| On statuary and other displays | 100 |

(1) Dark paintings with fine detail should have 2 to 3 times higher illumination.
(2) In some cases, much more than 100 footcandles is necessary to bring out the beauty of statuary.

| HOSPITALS | |
|---|---|
| Anesthetizing and preparation room | 30 |
| Auditorium | |
| Assembly | 15 |
| Exhibition | 30 |
| Autopsy and morgue | |
| Autopsy room | 100 |
| Autopsy table | 2500 |
| Morgue, general | 20 |
| Central sterile supply | |
| General | 30 |
| Needle sharpening | 150 |
| Corridor | |
| General | 10 |
| Operating and delivery suites and laboratories | 20 |
| Cystoscopic room | |
| General | 100 |
| Cystoscopic table | 2500 |
| Dental suite | |
| Waiting room | |
| General | 15 |
| Reading | 30 |
| Operatory, general | 70 |
| Instrument cabinet | 150 |
| Dental chair | 1000 |
| Laboratory, bench | 100 |
| Recovery room | 5 |
| Dining room (see Restaurants) | |
| Electroencephalographic suite | |
| Office | 100 |
| Workroom | 30 |
| Patients' room | 30 |
| Emergency room | |
| General | 100 |
| Local | 2000 |
| EKG, BMR and Specimen room | |
| General | 20 |
| Specimen table (supplementary) | 50 |
| Examination and treatment room | |
| General | 50 |
| Examining table | 100 |
| Eye, ear, nose and throat suite | |
| Dark room | 10 |
| Eye examination and treatment room | 20 |
| Ear, nose and throat room | 20 |
| Exits, at floor | 5 |
| Flower room | 10 |
| Formula room | 30 |
| Fracture room | |
| General | 50 |
| Fracture table | 200 |
| Kitchen | |
| Central | 70 |
| Floor, kitchen and pantry | 70 |
| Dishwashing | 30 |
| Laboratories | |
| Assay rooms | 30 |
| Work tables | 50 |
| Close work | 100 |
| Laundry | |
| General | 30 |
| Pressers and ironers | 70 |
| Sorting | 70 |
| Libraries | 70 |
| Linen closet | 10 |
| Locker rooms | 20 |
| Lobby | 30 |
| Lounge rooms | 30 |
| Maintenance shop | |
| General | 30 |
| Work benches | 100 |
| Paint storage | 10 |
| Medical records room | 100 |
| Nurses' station | |
| General | 20 |
| Desk and charts | 50 |
| Medicine room counter | 100 |
| Nurses' workroom | 30 |
| Nurseries | |
| General | 10 |
| Examination table | 70 |
| Play room, pediatric | 30 |
| Obstetrical | |
| Clean-up room | 30 |
| Scrub-up room | 30 |
| Labor room | 20 |
| Delivery room, general | 100 |
| Delivery table | 2500 |
| Offices (See Offices) | |
| Parking lot | 5 |
| Power plant | |
| Boiler room | 10 |
| Machine room | 20 |
| Switchboard room | 30 |
| Transformer room | 10 |
| Pharmacy | |
| General | 30 |
| Work table | 100 |
| Active storage | 30 |
| Alcohol vault | 10 |
| Private rooms and wards | |
| General | 10 |
| Reading | 30 |
| Psychiatric disturbed patients' areas | 10 |
| Radioisotope facilities | |
| Radiochemical laboratory | 30 |
| Up-take measuring room | 20 |
| Examination table | 50 |

| HOSPITALS (continued) | Currently Recommended Illumination* Footcandles |
|---|---|
| Retiring room | 10 |
| Sewing room | |
| General | 20 |
| Work area | 100 |
| Solariums | 20 |
| Stairways | 20 |
| Storage, central | |
| General | 15 |
| Office | 70 |
| Surgery | |
| Instrument and sterile supply room | 30 |
| Clean-up room (instruments) | 100 |
| Scrub-up room | 30 |
| Operating room, general | 100 |
| Operating table | 2500 |
| Recovery room | 30 |
| Therapy | |
| Physical | 20 |
| Occupational | 30 |
| Toilets | 10 |
| Utility room | 20 |
| Waiting room | |
| General | 15 |
| Reading | 30 |
| X-ray room and facilities | |
| Radiography and fluoroscopy | 10 |
| Deep and superficial therapy | 10 |
| Darkroom | 10 |
| Waiting room, general | 15 |
| Waiting room, reading | 30 |
| Viewing room | 30 |
| Filing room, developed films | 30 |
| Storage, undeveloped films | 10 |
| HOTELS | |
| Auditoriums | |
| Assembly only | 15 |
| Exhibitions | 30 |
| Dancing | 5 |
| Bars and cocktail lounges (see Restaurants) | |
| Bathrooms | |
| Mirror‡ | 30 |
| General | 10 |
| Bedrooms | |
| Reading (books, magazines, newspapers) | 30 |
| Inkwriting** | 30 |
| Make-up†† | 30 |
| General | 10 |
| Corridors, elevators and stairs | 20 |
| Dining areas (see Restaurants) | |
| Entrance foyer | 30 |
| Front office | 50 |
| Kitchen (see Restaurants) | |
| Laundry | |
| Washing | 30 |
| Flat work ironing | 50 |
| Machine and press finishing | 70 |
| Linen room | |
| Sewing | 100 |
| General | 20 |
| Lobby | |
| General lighting | 10 |
| Reading and working areas | 30 |
| Marquee | |
| Dark surroundings | 30 |
| Bright surroundings | 50 |
| Offices | |
| Accounting | 150 |
| General | 100 |
| Reception | 30 |
| Power plant | |
| Boiler room | 10 |
| Equipment room | 20 |
| Storerooms | 10 |
| Work shops (See Machine Shops and Woodworking, under Industrial Areas Section) | |
| MUSEUMS (SEE ART GALLERIES) | |
| PROFESSIONAL OFFICES (SEE HOSPITALS) | |
| RESTAURANTS, lunch rooms, cafeterias | |
| Dining Areas | |
| Cashier | 50 |
| Intimate type | |
| Light environment | 10 |
| Subdued environment | 3 |
| For cleaning | 20 |
| Leisure type | |
| Light environment | 30 |
| Subdued environment | 15 |
| Quick service type | |
| Bright surroundings†† | 100 |
| Normal surroundings†† | 50 |
| Food displays — twice the general levels but not under | 50 |
| Kitchen, commercial | |
| Inspection, checking and pricing | 70 |
| Other areas | 30 |

## Notes on Institutions

*Minimum on the task at all times.
**Pencil handwriting, reading of reproductions and poor copies require 70 footcandles.
†This may be done in the bathrooms, but if a dressing table is provided, local lighting should provide the level recommended.
††Including street and nearby establishments.
‡For close inspection, 50 footcandles.

# OFFICES

| OFFICES | Currently Recommended Illumination* Footcandles |
|---|---|
| Cartography, designing, detailed drafting | 200 |
| Accounting, auditing, tabulating, bookkeeping, business machine operation, reading poor reproductions, rough layout drafting | 150 |
| Regular office work, reading good reproductions, reading or transcribing handwriting in hard pencil or on poor paper, active filing, index references, mail sorting | 100 |
| Reading or transcribing handwriting in ink or medium pencil on good quality paper, intermittent filing | 70 |
| Reading high contrast or well-printed material, tasks and areas not involving critical or prolonged seeing such as conferring, interviewing, inactive files and washrooms | 30 |
| Corridors, elevators, escalators, stairways | 20 (or not less than ⅛ level in adjacent areas) |
| BANKS | |
| Lobby | |
| General | 50 |
| Writing areas | 70 |
| Tellers' stations | 150 |
| Posting and keypunch | 150 |
| Regular office work | 100 |
| DEPOTS, TERMINALS AND STATIONS | |
| Waiting room | 30 |
| Ticket offices | |
| General | 100 |
| Ticket rack and counters | 100 |
| Rest room and smoking room | 30 |
| Baggage checking | 50 |
| Storage | 20 |
| Concourse | 10 |
| Platforms | 20 |
| Toilets and washrooms | 30 |
| Drafting rooms (see Offices) | |
| MUNICIPAL BUILDINGS (Fire and Police) | |
| Office work, corridors, elevators, stairways, washrooms (see Offices) | |
| Police | |
| Identification records | 150 |
| Jail cells and interrogation rooms | 30 |
| Fire Hall | |
| Dormitory | 20 |
| Recreation room | 30 |
| Wagon room | 30 |

| | Currently Recommended Illumination* Footcandles |
|---|---|
| POST OFFICES | |
| Lobby, on tables | 30 |
| Sorting, mailing, etc. | 100 |
| Storage | 20 |
| Files (see Offices) | |
| Corridors and stairways | 20 |

*Minimum on the task at all times.

## STORES

| | Currently Recommended Illumination* Footcandles |
|---|---|
| Show windows | |
| Daytime lighting | |
| General | 200 |
| Feature | 1000 |
| Nighttime lighting | |
| Main business districts — highly competitive | |
| General | 200 |
| Feature | 1000 |
| Secondary business districts or small towns | |
| General | 100 |
| Feature | 500 |
| Open-front stores (see Display lighting under Store interiors) | |
| Store interiors | |
| Circulation areas | 30 |
| Merchandising areas | |
| Service | 100 |
| Self-service | 200 |
| Showcases and wall cases | |
| Service | 200 |
| Self-service | 500 |
| Feature displays | |
| Service | 500 |
| Self-service | 1000 |
| Stockrooms | 30 |

(1) Above values are illumination on the merchandise on display or being appraised. The plane in which lighting is important may vary from horizontal to vertical.
(2) Specific appraisal areas involving difficult seeing may be lighted to substantially higher levels.
(3) Color rendition of fluorescent lamps is important. Incandescent and fluorescent usually are combined for best appearance of merchandise.
(4) Illumination may often be made non-uniform to tie in with merchandising layout.
*Minimum on the task at all times.

## RESIDENCES

| | Currently Recommended Illumination* Footcandles |
|---|---|
| SPECIFIC VISUAL TASKS* | |
| Table games | 30 |
| Kitchen activities | |
| Sink | 70 |
| Range and work surfaces | 50 |
| Laundry, trays, ironing board, ironer | 50 |
| Reading and writing, including studying | |
| Books, magazines, newspapers | 30 |
| Handwriting, reproduction and poor copies | 70 |
| Desks, study | 70 |
| Reading music scores | |
| Simple scores | 30 |
| Advanced scores (When score is substandard size, and notations are printed on the lines, 150 footcandles or more are needed.) | 70 |
| Sewing | |
| Dark fabrics (fine detail, low contrast) | 200 |
| Prolonged periods (light to medium fabrics) | 100 |
| Occasional periods (light fabrics) | 50 |
| Occasional periods (coarse thread, large stitches, high contrast thread to fabric) | 30 |
| Shaving, make-up, grooming; on the face at mirror locations | 50 |
| Work shop, bench work | 70 |
| GENERAL LIGHTING | |
| Entrances, hallways, stairways, stair landings | 10† |
| Living room, dining room, bedroom, family room, sun room, library, game or recreation room | 10† |
| Kitchen, laundry, bathroom | 30 |

*Minimum on the task at all times.
**Brightness of visual task must be related to background brightness.
†General lighting for these areas need not be uniform in character.

## MARINE TRANSPORTATION

| | Currently Recommended Illumination* Footcandles |
|---|---|
| LIVING AREAS | |
| Staterooms | |
| Crew | 5** |
| Officers | 5** |
| Passengers | 5** |
| Berth, on reading plane | 15 |
| Mirrors, at face | 50 |
| Baths | |
| Crew | 5 |
| Public | 5 |
| Officers | 5 |
| Passengers | 5 |
| Mirrors, at face | 50 |
| Passageways | 5 |
| Stair foyers, passenger | 10 |
| Stairs | |
| Passenger | 10 |
| Crew | 5 |
| Entrance, passenger | 10‡ |
| Lounges, passenger and officers | 10**† |
| Recreation rooms, crew | 20 |
| On tables | 30 |
| Dining room, passengers | 10† |
| Mess room, officers and crew | 10 |
| On tables | 15 |
| Libraries | 10 |
| For reading | 30 |
| Smoking rooms | 5**† |
| Enclosed promenades, along inboard bulkhead for reading | 10 |
| Barber shop and beauty parlor | 20 |
| On subject | 50 |
| Cocktail lounges | 5† |
| Bars | 5† |
| Ball rooms | 5† |
| Swimming pools, indoor beaches | 10 (Also underwater lights and sun lamps) |
| Shopping areas | 20** |
| Theatres | |
| During show | 0.1 |
| Intermission | 5 |
| Gymnasiums | 20 |
| Hospital | |
| Operating room | 50** |
| Dental room | 30** |
| Dispensary | 30** |
| Wards | 5** |
| Doctor's office | 2[illegible]** |
| Waiting room | [illegible]** |
| Radio room, passenger foyer | [illegible]** |
| Passenger counter, purser's office | 20 |

| | Currently Recommended Illumination* Footcandles |
|---|---|
| **NAVIGATING AREAS** | |
| Wheelhouse (not used underway) | 5 |
| Chart room | 10 |
| On chart table | 50 |
| Radar room | 5 |
| Gyro room | 5 |
| Radio room | 10** |
| Ship's offices | 20 |
| On desks and work tables | 50 |
| For bookkeeping and auditing | 50 |
| Log room | 10 |
| On desk | 50 |
| **SERVICE AREAS** | |
| Galley | 20** |
| Laundry | 15** |
| Pantry | 15** |
| Sculleries | 15** |
| Food preparation | 20** |
| Food storage (non-refrigeration) | 5 |
| Refrigerated spaces (ship's stores) | 5 |
| Butcher shop | 15** |
| Print shop | 30** |
| Tailor shop | 50** |
| Post offices | 20** |
| Lockers | 3 |
| Telephone exchange | 10** |
| Store rooms | 5 |
| **OPERATING AREAS** | |
| Engine rooms (working areas) | 10** |
| Boiler rooms (working areas) | 10** |
| Fan rooms | 5 |
| Motor generator rooms (cargo handling) | 5 |
| Generator and switchboard rooms | 10 |
| Windlass rooms | 5 |
| Switchboards, vertical illumination | |
| At top | 30 |
| Three feet above deck | 10 |
| Steering gear room | 5 |
| Pump room | 1 |
| Gauge and control boards (vertical illumination) | |
| On gauges | 30 |
| Shaft alley | 3 |
| Dry cargo holds (permanent fixture) | 1** |
| Refrigerated cargo loading and unloading | 3** |
| Work shops | 20 |
| On work | 50 |
| Cargo hatches | |
| Over hatch area | 5 |
| Adjacent deck area | 3 |

*Minimum on the task at all times.
**Supplementary lighting should be provided in this space to produce the higher levels of lighting required for specific seeing tasks involved.
†In public areas such as lounges, ballrooms, bars, smoking rooms and dining rooms, the footcandle values may vary widely, depending upon the atmosphere desired, the decorative scheme and the use made of the room.
‡The installation should be such that the level of illumination can be increased to at least 40 footcandles for daytime embarkation.

# Now We Know

**By KIRK M. REID, *President***
***Illuminating Engineering Society***

I.E.S. MEMBERS individually, the Society in general, and the Society's Sustaining Members most especially, can take pride in the reports on researches in illumination which precede this page. It was in large measure their earnestness in seeking knowledge, their foresightedness — and their investment of many thousands of dollars which have given us a valid, scientific basis of footcandle recommendation. One gap in our knowledge which has long baffled our committees has been filled. Now we know how to evaluate with reasonable accuracy what quantity of light should be our goal in providing illumination for any given seeing task.

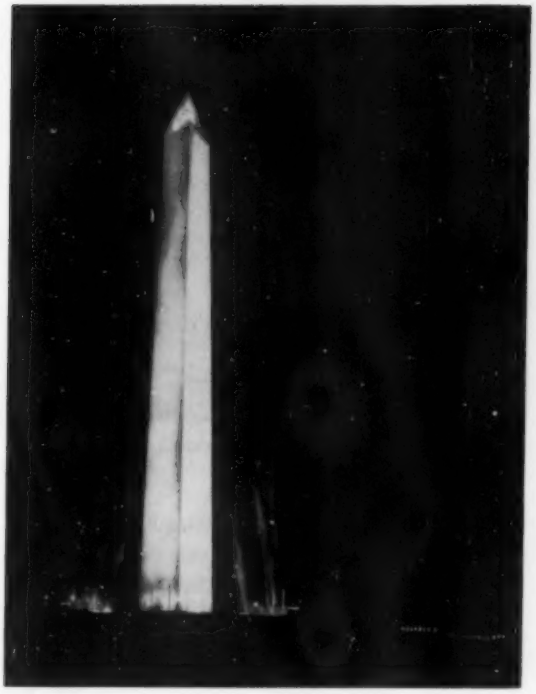
The fruits of the research project just reported may serve to stimulate our eagerness for research results still to come — some of them soon. The Illuminating Engineering Research Institute, under whose aegis this research was done, has many other projects under way. In point of fact, the evaluation of quantity research by Blackwell is only one phase of a several-part study on *quantity* of illumination. There are other researches now in progress also on *quality*, on computers for the accurate prediction of illumination, and on roadway lighting. We may look forward in due time to other answers we have needed, to name a few:

- The quantity needed for older eyes,
- The quantity needed for eyes having subnormal vision,
- Ocular motor effects — how eyes focus under varying levels of illumination,
- Discomfort glare,
- Brightness ratios,
- Specular reflection,
- Predicting illumination values,
- Visibility evaluation on lighted roads.

All of us as individual members are interested in the research program of the I.E.R.I. The Society's own interest as an organization is, of course, substantial. I.E.S. investment in the I.E.R.I. research projects so far completed and still to come, now exceeds a quarter of a million dollars. This is not a huge sum by any means, but substantial. Extending its value many-fold are the advantages these researches have had in making use of existing university facilities and highly trained university personnel. We have been fortunate that our contributions have thus so greatly been multiplied.

As to the fruits of the I.E.R.I. researches — we are pleased and proud to have shared in furthering the things lighting can do for mankind — to enrich, to safeguard, and to lighten his burden.

# Relighting the Washington Monument



By JOHN S. HANEY

On February 22, 1958, 226 years after the birth of George Washington, a new floodlighting system for the Washington Monument was turned on by Ulysses Grant III, head of the Washington Monument Society. The 555-foot 5⅛-inch high obelisk stood out against the darkness, becoming at night what it has always been during the day — the District of Columbia's most distinctive landmark.

The new floodlighting produces an average optimum of 5 footcandles at the base of the Monument and 11 footcandles at the top. The system it replaces delivered only 0.75 footcandle. The monument is now one of the most spectacular sights in the capital city.

The monument is at the physical center of that part of Washington which annually attracts thousands of tourists to the city. It stands on a slight rise of ground in a large, attractively landscaped park, which borders Constitution Avenue on the north, 15th Street on the east, and the Tidal Basin of the Potomac River on the south; the west side or back of the park faces several rows of temporary office buildings and, farther back, the Lincoln Memorial. A circular driveway opening on 15th Street surrounds the structure. Along the inner curb are park benches and along the outside curb are flag poles from which, on ceremonial occasions, fly the flags of the states.

Faced with white Maryland marble, the monument conforms to the classic conception of an obelisk — a tall four-sided stone pillar tapering to a pyramidal top. Each side of the shaft is 53 feet 1⅛ inches at the base and 34 feet 5½ inches at the top. Its walls are 15 feet thick at the base and 18 inches at the top.

### Planning the Floodlighting

Two theories for floodlighting the structure were originally considered: to locate luminaires at points opposite the corners of the monument so that each bank of lights would provide overlapping illumination to two adjacent sides, or to locate the luminaire banks at points opposite the faces so that light can overlap only vertically up and down the shaft.

The first plan would tend to minimize spottiness in case of lamp failure, because of the overlapping of beams. But it would also tend to minimize the corners of the four-sided structure. It would also require that the fixtures light the faces of the monument from sharper angles, thereby decreasing the installation's efficiency.

In addition to greater efficiency, the second plan, which was chosen, met an important esthetic requirement. In sunshine the structure always has

Author: Manager, Illumination Sales, Crouse-Hinds Co., Syracuse, N. Y.

**Outer bank of floodlight vaults, opening.**

two sides in shadows and two sides brightly reflective, retaining the sharpness and contrast of all four corners. To achieve this appearance at night, variation in lighting level on adjacent faces is necessary to maintain the true depth and squareness. Another phenomenon which governed the type, placement and technical characteristics of the floodlights is that of an illuminated surface becoming dimmer as it recedes from the viewer. The upper reaches of the monument require higher levels than does the lower portion.

Five lamp types were studied: incandescent, high-pressure mercury-arc, high-pressure xenon-arc, combination mercury-xenon-arc and carbon-arc. After consideration of lamp characteristics and equipment necessary, incandescents were selected, for their color, safety, convenience and economy.

The type and number of floodlights required for each side of the structure were then calculated. Selection was on the basis of beam spread and concentration; actual operation was plotted and illumination data from each calculated and located to scale on a drawing of the monument. During this process, reflector, lens and lamp combinations giving the best results at various levels were selected. A base point was reckoned 100 feet horizontally from the face of the structure and calculations were premised on this location. This distance was picked as the best compromise between normal incidence of beam and length of throw. All calculations were made on a point-by-point basis.

Prepared plots of the individual floodlights were reproduced in multiple on acetate film. Since they were the same scale, it was possible to superimpose the transparencies and determine total illumination using various combinations of units.

In the preliminary design, two assumptions were made. First, that the illumination level on the north and south sides should vary from about 5 footcandles at the base to approximately 11 footcandles at the 500-foot point; second, that the levels on the east and west sides should be 1½ to 2 footcandles less, at all points, than those on the north and south sides. The first assumption worked out satisfactorily in a test held in March 1957; the 1:2 gradation of light from ground level to 500-foot level presents a uniform pleasing effect, either close by or from a distance. But the difference in footcandle level of north and south faces compared

## *History of the Washington Monument*

Built at intervals between 1848 and 1885 with funds from public subscriptions and Federal appropriations, the monument memorializes George Washington and his achievements. The suggestion for building a monument in his honor was first considered by the Continental Congress but over a century passed before the edifice which now stands beside the Potomac River was finally built, dedicated and formally opened to the public.

A series of major events in our national life forced Congress — and, later, certain distinguished private citizens, who had assumed the task of raising funds to erect the memorial — occasionally to forsake their efforts to finish it. The War of 1812, political obstacles, financial panic in the 1850's, and finally the eruption of the Civil War, all combined to delay its completion. For almost 25 years the monument stood unfinished at the height of 153 feet.

In 1875, President Grant approved an act which required the Federal government to complete the work, assigning the job to the Army Engineer Corps. In 1880, construction resumed. By 1884, the shaft was 500 feet high. Four years later the

to that on east and west sides was found to be insufficient for good corner demarcation. As a result, all banks of floodlights are identical, but are controlled in pairs (N-S and E-W) by induction voltage regulators which not only give the necessary variation (up to 50 per cent) but also provide the facility of change from time to time.

### Mounting the Floodlight Banks

Since its public opening 70 years ago, the Washington Monument has attracted a total of over 31 million people. Almost every moment of the day visitors are present, either walking about the grounds, riding up in the elevator to the observation windows, or even climbing the 898 steps that make up its passageway. Because of this constant traffic, National Capitol Parks was especially interested in having as little floodlighting exposed as is possible. Nothing is to distract the attention or impede the activity of visitors. For this reason, all lights were specially mounted, either in vaults or on concrete pedestals.

The vaults are made of concrete, 18 feet long, 13 feet wide and 11 feet deep, protruding only 18 inches above the ground. The four vaults bordering the outer curb of the circular driveway contain 19 floodlights each. Their steel-trussed aluminum covers open in halves, hinged along the long sides, and are raised by means of an hydraulically operated sliding steel leaf at each end of the vault in a manner similar to that of a sidewalk elevator. Both the vertical leaves and the doors adequately shield the vault luminaires from passers-by. Lamps

**Inner bank of floodlight vaults.**

are 1000 to 1500 watts with narrow beam reflectors and tempered lenses.

Inner banks of floodlights are located in four concrete footlight vaults set 19 feet away from the base of the monument. These illuminate the lower areas of the faces to a height of about 60 feet. On the west and south sides the vaults each contain a single row of nine narrow-beam fixtures, five with diffusing lenses and four with horizontal spread lenses. On the north side, where a dedicatory plaque is located, and on the east side, where the main entrance stands, the footlights have been divided — five fixtures on one side and four on the other.

Pyramidion lighting is by heavy-duty, cast aluminum searchlights, mounted in pairs on four

## *and the Renovation Program*

capstone was finished and set in place. Finally, 105 years after it had originally been proposed, the memorial to Washington was completed, on December 6, 1884.

The new floodlighting system is 14 times as powerful as was the previous one. The old fixtures were mounted at the base of the shaft about 50 feet from each side, in protective wooden boxes with five units in each box. In addition, two searchlights were used to illuminate the pyramidion. These were located at some distance, one on the Bureau of Engraving building and the other on a temporary office building, lighting the upper portions of the southeast and northwest sides.

The re-lighting program is under National Capitol Parks, of the Department of Interior's National Park Service. The refurbishing of the Washington Monument is a part of Mission 66, a construction and renovation program of the Department. This project will, by 1966, complete a number of parks, patriotic shrines and special road systems to better conserve the "scenic, scientific and historic heritage of the United States for the benefit and enjoyment of its people."

**Searchlights on pedestal.**

pedestals at a distance of 568 feet from the structure. Pedestals are 15 feet high and 6½ feet in diameter. Conduit channel runs the length of each column, connecting buried cables with two single-phase 120/240 transformers set in a cast metal weatherproof condulet in the center of the pedestal top. Design of the pedestals is such that they may be uprooted and relocated as necessary to accommodate changes in landscaping.

Two luminaires were selected for each pedestal since their location was dictated by the physical limits, use and general appareance of the tract. Wide expanses, unencumbered by apparatus remained available by placing the pedestals opposite the corners of the monument. Here the philosophy of lighting on the faces took second place to available location.

The searchlight units have gasketed doors, silvered-glass parabolic reflectors, clear plate glass lenses and use 1000-watt lamps. Concentrated beam spread is only 3.6 degrees horizontal and 3.0 degrees vertical. To control light spill the beam paths of each pair of searchlights is crossed. For instance, the two units at the northeast corner are aimed at the north and east faces, crossed for better lineation along the pyramidion's edges as well as prevention of excessive spillage of light.

### Floodlighting Control

Burning time at present is daily from dusk until midnight. Units are turned on very simply. First, the vault covers near the base of the shaft are unlocked, opened and secured. Then, the main vaults are opened by means of key switches set into their outer walls. Limit switches automatically stop the operation of the doors when they are fully open or closed, even though the vault key switch is activated. Final step is merely to push a start button located under the monument in the guards' room. Reversing this procedure turns the lighting off.

To vary the level of illumination, two 120/208-volt, three-phase 60-cycle induction voltage regulators are housed in the underground equipment room. Manually operated, each controls the lighting for two sides of the building—north and south, east and west.

So far, lighting on the north and south sides has been maintained at 5 footcandles at the lower portion and 11 footcandles at the top. East and west sides are held to approximately 2½ footcandles and 5½ footcandles at bottom and top, but it is expected that this will be readjusted occasionally. Voltage output of the regulators is ±20 per cent of normal line voltage.

### Obstruction Lighting

Eight aircraft warning lights are mounted in specially cut openings in the pyramidion walls above the observation windows, for obstruction lighting. These are controlled automatically by a photoelectric cell located on the northwest searchlight pedestal or, if necessary, by manual control in the guards' rooms. The lights operate in groups, two lights on each of the four pyramidion faces are alternately "on" then "off" in cycles of approximately six seconds duration. A flasher provides the necessary control.

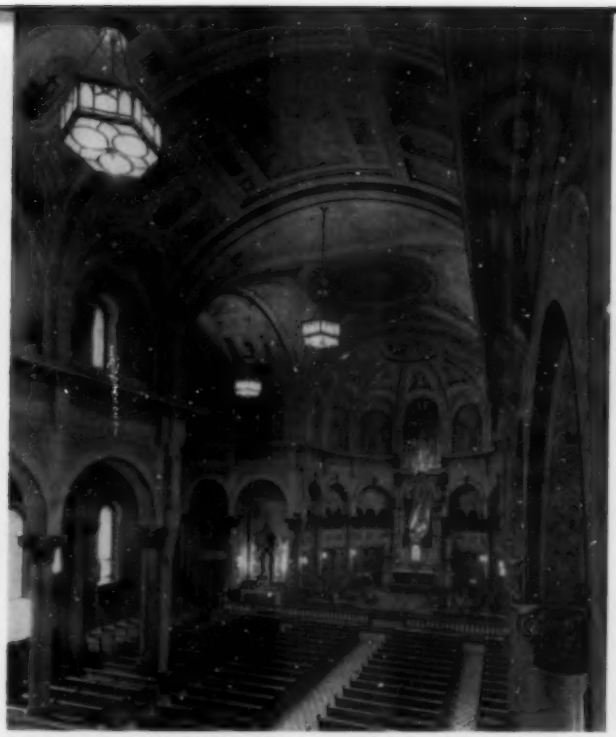

### Acknowledgements

New floodlighting and electrical services were planned and supervised by Kluckhuh, Cobb & McDavid, engineering consultants, with McLeod & Ferrara as architectural associates and J. Gibson Wilson as structural engineering associate. Seal & Co. were the general and electrical contractors. All are Washington, D. C., firms.


### Reprints of "Recommended Levels of Illumination"

Beginning on page 415 of this issue will be found a special editorial feature including RQQ Report #1 and the new official footcandle requirements for six different areas: Office, Industrial, Institutions, Residences, Stores and Marine Transportation.

Because of the intense industry-wide interest which has been generated by the Blackwell studies and these resulting higher levels, a limited number of reprints of this 20-page feature will be available in the near future at 20 cents each in any quantity. Since the *complete* footcandle tables will not be published until they appear in the Third Edition, *IES Lighting Handbook* in March 1959, copies of this feature will serve for reference purposes in the meantime. Order from Publications Office, Illuminating Engineering Society, 1860 Broadway, New York 23, N. Y.



# *Sacred Heart Cathedral*

DIFFICULTIES encountered in re-lighting the Sacred Heart Roman Catholic Cathedral in Hamilton, Ont., included the necessity of using only the existing outlets, since the interior was completely covered by murals and other works of art which could not be altered. The outlets available were: two in the nave, one in each transept, five in each of the side aisles, three under the choir area, one over the choir, six in the sanctuary and none at all at the side altars and the stained glass window in the sanctuary. All outlets are on the ceiling, except in the sanctuary, where they are in the walls.

Transepts and nave of the building rise in a dome 65 feet from the floor. Side aisles are 30 feet high. Prior to the re-lighting, the best illumination level obtainable in any part of the building on the brightest day was two to three footcandles.

In the design of the lighting system, consideration was given to the need for considerable uplight to show the paintings on the ceiling in all their beauty. Shielded downlight is also provided in sufficient quantities for the visual tasks performed. General illumination at reading level is approximately 15 footcandles.

This installation won first prize, for John H. Mills, Chadwick-Carroll Brass & Fixtures Ltd., in the Hamilton Ontario Chapter's 1958 contest for My Most Interesting Lighting Job.

## Equipment Used

**Nave and Transepts** — 60-inch diameter, 25-inch high, solid bronze units with three 100-watt lamps on separate circuits for downlight, six 100-watt inside-frosted lamps for improved color, six 150-watt PAR floods on separate circuits to light the murals on the arch of the dome. Prismatic reflectors have concentric louver shielding; remainder of the bottom and the sides of the fixture are of sanded amber cathedral glass.

**Sanctuary** — Six wall-mounted lanterns around perimeter, with prismatic reflectors and secondary lighting for the side glass panels. For main altar: 150-watt PAR floods, directed up to illuminate the sanctuary dome. Stained- and cut-glass window: 8-foot slimline lamps behind the glass for general lighting and 150-watt PAR floods for sparkle.

**Side Altars** — Specially-designed bracket shield fixtures, four feet in height and two feet wide, made of bent amber sanded cathedral glass, with two 18-inch lumiline lamps mounted end-to-end to illuminate the shield and five 75-watt R30 floods, mounted behind the shield to direct light upward, outward and downward. Flood lamps are on separate circuit and mounted on adjustable locking type swivels. Wiring is by cable from the nearest outlet.

**Side Aisles** — Lanterns, matching in style the nave units, with 500-watt prismatic reflectors, shielded with louvers, for downlight; three 150-watt lamps on separate circuit for upward component.

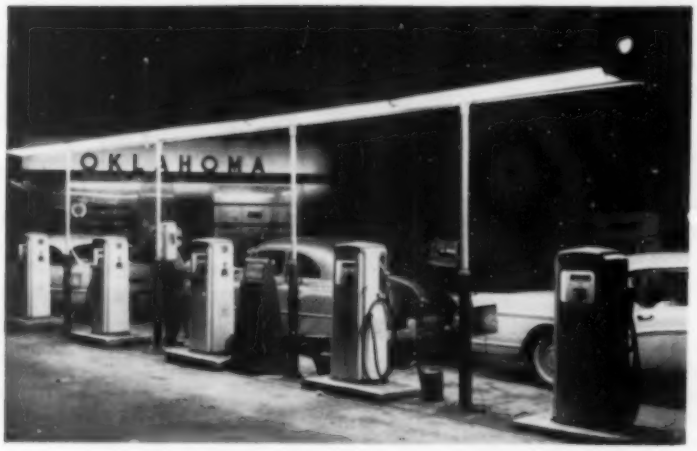
**Choir Area** — Over choir: one lantern similar to those in side aisles; under choir at rear of nave: three similar lanterns.

# High Output Fluorescent

FIRST mentioned in ILLUMINATING ENGINEERING in the 1956 Progress Report, published January 1957, and reported on at the 1957 National Technical Conference of I.E.S., fluorescent lamps of non-circular cross-section are finding application in varied installations. Shown here are some of the areas listed. For an application in bowling alleys, see article on page 441.

**General illumination is 85 footcandles at the Johnson Hill Department Store in Wisconsin Rapids, Wis., with 96-inch high-output lamps in louvered white enamel fixtures. Units are mounted at 22 feet from the floor.**

**Low-bay area at the A. C. Sparkplug Co. uses high-output lamps to get 65 footcandles in their Flint, Mich., plant. Forty-eight two-lamp fixtures, with 15 per cent upward component, are mounted at 18 feet.**

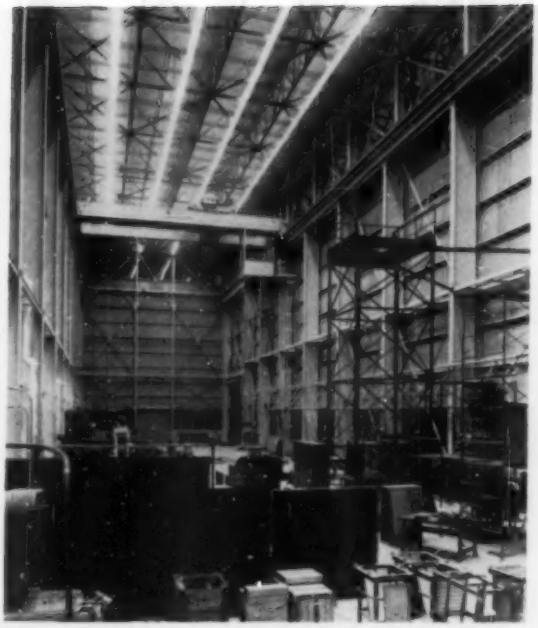



**Pump island and surrounding areas of the Oklahoma Service Station, Cleveland, Ohio, are lighted by two continuous rows of two-lamp luminaires with 96-inch non-circular fluorescent lamps.**

Except as otherwise noted, photos and data courtesy of the General Electric Co., Cleveland, Ohio.

in

- high-bay industrial
- low-bay industrial
- department store
- office
- service stations



Parts assembly operations at the new General Electric Co. Atomic Power Equipment Department, San Jose, Calif., require a 50-ton crane with a lift of 51 feet. Design of the crane set the limit of 64 feet as minimum luminaire mounting height above the floor. A total of 108 open two-lamp fixtures, with 15 per cent upward component, are mounted at this height. Illumination levels from the high-output lamps, after 500 hours operation, measured 66 footcandles on the horizontal plane and 35-40 on the vertical. Relamping and maintenance are from the crane. Ceiling is white, 70% RF; walls are natural Transite, 30% RF; floor is light gray, 30% RF. Photo and data courtesy of Day-Brite Lighting Inc., St. Louis, Mo.

Proper shielding is a "must," especially when high-output lamps are used in office areas. Here, at Paramount Industries, Flint, Mich., six two-lamp louvered luminaires are mounted side by side, forming an 8- x 8-foot recessed plenum, with the appearance of a louver-all ceiling. The 12 96-inch high-output TG lamps provide 500 footcandles. Air-conditioning system above ventilates through the luminaires.

Coil-winding department of the Elliott Co., makers of electric motors, is lighted to a level of 150 footcandles by 96-inch high-output TG lamps in two-lamp fixtures, mounted at 21 feet from the floor.

## High-Output Fluorescent

Four-lamp floodlighting units, using 48-inch non-circular cross-section fluorescent lamps, light the driveways of Gastown Service Station, Eastlake, Ohio.

A total of 6000 high-output lamps are used in this aircraft plant high-bay area. Two-lamp 8-foot shielded units are installed 37 feet above the floor 10 feet on centers in continuous rows which are on 30-foot centers. Photo courtesy of Fluorescent Fixtures of California, South San Francisco, Calif.

This 20,000 square foot area at Erickson Tool Co., Solon, Ohio, is lighted by 230 industrial fixtures each using two high-output lamps. Units, which have upward component, are arranged in continuous rows ten feet on centers and ten feet from the floor. Additional fixtures are mounted crosswise between rows on twelve-foot spacing in the grinding area, where tolerances are closer. After 2400 hours operation, levels of 180 and 250 are maintained in these areas.

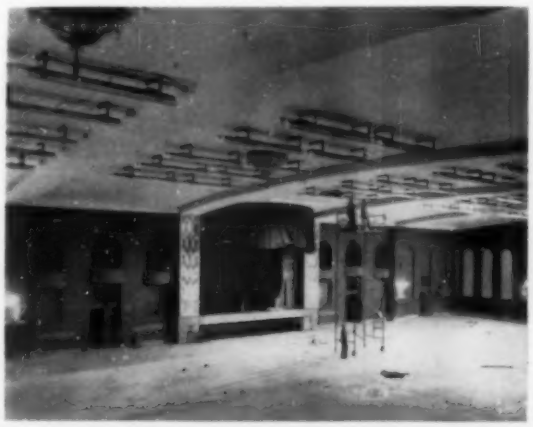
Levels of over 200 footcandles for tournament and televised bowling and 100 footcandles for "bowling night" play are achieved by use of high-output lamps in well-shielded fixtures in these Kansas City

# BOWLING ALLEYS

By ROBERT W. WILSON

CONVERTING the biggest ballroom in Kansas City to modern bowling alleys presented several unusual problems. The owners of Pla-Mor Bowling Alleys wanted high level illumination for tournament bowling and televising. They also wanted to retain the high arched ceiling and general architectural design of the room. Shielding was necessary to conceal the sources from the players. The structural steel construction of the ceiling prevented the use of recessed fixtures or any lighting system which would have to be maintained from above.

The installation designed to meet these conditions consists of 100 two-lamp fixtures, using 8-foot high-output lamps, installed in banks of four each, concealed by 25 shields. A special hanger for fixtures and light shields was made from angle iron, by forming the triangle with an adjustable bolt at the top to provide an adjustment of fixture to the arched ceiling. These angles provided for simple installation. Shields are bolted to the back of the angle, completely concealing the light source from the bowlers. Shields are made of 18 gauge metal with two breaks in the back to provide the necessary rigidity. Triangular end plates on each end of



**Industrial-type luminaires are installed on special hangers. Shielding is also mounted on angle-irons.**

AUTHOR: Boese-Hilburn Electric Co., Kansas City, Mo. Architect for the remodeling was Herman A. Scharhag, North Kansas City, Mo. This installation won second prize, for Mr. Wilson, in the Heart of America Section's 1958 contest for My Most Interesting Lighting Job.

**View looking toward the bowlers' position shows also ceiling-hung luminaires over center alleys for use during television production of Saturday night tournaments.**

the shield conceal the sources from the sides.

Levels of over 200 footcandles are provided on the alleys when all fixtures are turned on. This is more than sufficient for championship tournament bowling and, with some additional lighting over the center alleys, for the weekly televised program, Saturday nights from 10 to 11. For other use, the circuits are installed in two separate panels, so that during regular league bowling only half the units are turned on, with resultant level of about 100 footcandles. Alternate circuits are used on alternate nights to improve maintenance. Fixtures are mounted at an average of 26 feet.

For tournament play or television, the center alleys have six more units, also with high-output lamps, over the approach area — four installed from the ceiling and two from the combination air-conditioning duct and scoreboards. These units provide an additional 110 footcandles on the horizontal plane of the lens in the television camera.

In the bowlers' seating and approach areas, incandescent dome fixtures are suspended at a height of 12 feet from the floor. Recessed units are installed in the false bottom of the air-conditioning duct over the foul line. The large urns on the side walls, which provided part of the atmosphere for the old ballroom, have amber lights to provide color on the side walls.

Side walls are sand beige, 64% RF; ceiling is a warm platinum color, 76% RF; curtain wall over pins has a turquoise base and three-color splatter, 55% RF. The inside of the fixture shields is a white enamel and the back is painted to match the ceiling.

## Discussion of I.E.S. Conference Papers

Discussion of papers presented at the technical sessions of the Toronto Conference should be submitted immediately for publication with the paper in ILLUMINATING ENGINEERING.

Send: One copy (original) to Miss Ruby Redford, Editor, ILLUMINATING ENGINEERING, 1860 Broadway, New York 23, N. Y.

One copy to Floyd W. Sell, Chairman, Papers Committee, Detroit Edison Co., 2000 Second Ave., Detroit 26, Mich.

One copy to the author of the paper.

# MERCURY lights this office

By T. C. SIDLO

THIS COULD have been a routine lighting job had it not been for an electrical contractor with pioneer blood, a plant engineer sympathetic to new lighting practices, and a short article in ILLUMINATING ENGINEERING.

The article appeared in the June 1956 issue (p. 457) and told of an office that had been lighted successfully with a single mercury lamp over a plastic luminous ceiling. Art Smiley, Jr. (the electrical contractor) and I discussed the installation casually at the time the article appeared. The technique was unique, to say the least; since the results were so successful, it was certainly interesting. This was just shop-talk, however, and I soon forgot about it. Apparently Mr. Smiley didn't. In working out details for a relighting job of an office-drafting room, he reminded me of our conversation. The office, in the Sheffield Steel Division of Armco in Kansas City, Missouri, had dimensions that lent itself very well to this unorthodox technique; its dimensions were 14 feet by 43 feet, with a ceiling 14 feet high. High levels were, of course, required for the combination office and drafting tasks.

Our objective was to provide levels necessary for critical drafting with a minimum of light sources and a near minimum of wattage consumption. Fluorescent lamps of the 1500-milliampere design were not commercially available at the time but one 1000-watt mercury lamp we know, was the equivalent in light output of seven 96-inch high output (800 ma) fluorescent lamps. We set to work to design what could well be the first mercury-lighted offices in the mid-west.

Our enthusiasm mounted as we considered that a mercury system in this particular area made lamp replacement easy and initial costs low. The latter advantage was even more enhanced by the fact that a 440-volt supply was already available and the simpler, lower cost 440-volt mercury ballast could be used.

We felt our problems were three-fold. (a) To provide a color of light acceptable to the occupants; (b) to provide evenly distributed illumination over the plastic ceiling, and therefore over the work area, even with so few luminaires, (c) acceptance by plant engineer, Walter Rankin, of this

**Within the plenum.**

AUTHOR: General Electric Co., Midwest Sales District, Kansas City, Mo. This installation won First Prize in the Heart of America Section contest for My Most Interesting Lighting Job; Third at The Midwestern Regional.

radical departure from standard practice.

Our proposed solution included a combination mercury and silver bowl incandescent system. Four H1000-C15 improved-color mercury lamps were proposed, to provide the basic footcandles. In addition, three 500-watt silver bowl lamps further improve the color, and at the same time add interreflections for greater light distribution. These sources also provide instantaneous light of a constant level when first entering the darkened room.

Layout couldn't be simpler. It consists of a single file of the mercury and silver bowl lamps on approximately 6-foot centers, mounted in mogul sockets. The silver bowl lamps are on 16-inch stems, with no reflecting surfaces other than the 5-foot 6-inch high plenum chamber painted a high reflectance flat white. All equipment is mounted over a wall-to-wall luminous element of 3-foot square corrugated vinyl. Ballasts are mounted remotely to avoid any ballast hum in the room.

After operating for 11 months (with a recent cleaning of the plastic panels) illumination level is an average 100 footcandles. The mercury sources supply 90 fc, the filament 10. Light distribution at desk level is satisfactory, varying from 82 footcandles near the wall, to 105 footcandles at room center. The color is quite acceptable to the occupants (all male). A pale pink finish to the walls and venetian blinds probably helps.

Were it not for the original high ceiling, allowing substantial space above the plastic ceiling, this system may not have been practical. Since it was there, we made use of it.

One question remains unanswered. Would *female* occupants enjoy working under mercury light?

## Cross hatched effect of interior lighting adds interest to exterior

**Interior illumination of the Warren Petroleum Corp. building in Tulsa is apparent from the exterior at night, since translucent ceilings produce a series of rectangular blocks of light with a background pattern of cross hatching. The lighting was designed by Skidmore, Owings & Merrill. It provides a type of broad-area illumination approximating the quantity and quality of light from an all-luminous ceiling but is designed for simpler maintenance. High level illumination is from continuous rows of luminaires, each about 3 feet by 5 feet 9 inches deep, separated by rows of 24-inch metal pans which snap into the supporting grid. There are 3000 of these units, suspended from yokes on special half-tee sections of the grid. Each unit contains two 40-watt rapid-start lamps with provision for a third, where a higher level of illumination may be desirable. The diffusers, which constitute about 60 per cent of the ceiling area, swing down for easy maintenance. By test, brightnesses are shown to be about equal whether vertical or parallel to the lamps. Brightness is about the same as a fully luminous ceiling. To the eye, the metal dividers are hardly noticeable although the camera picks out the difference in brightness values.**

**Photographs and data courtesy Wakefield Lighting Co., Vermilion, Ohio.**

# An Artist Looks at Gallery Lighting

By EVERETT WARNER

A PAINTER is always baffled by the discovery of excellent picture lighting in buildings devoted to business or commercial activities, while many of our art galleries have artificial illumination that is far less suitable for their particular requirements. To be specific, one wonders why the Manufacturer's Trust Company, at 43rd Street and Fifth Avenue, New York, is provided with illumination, which though somewhat too yellow for gallery use, has, to a marvelous degree, that high diffusion under which paintings look their best, while the Museum of Modern Art, a few blocks farther north, has been getting along with a light which is much too directional for the best presentation of art works. Or why is the Boston Museum of Fine Arts supplied with an artificial light which, for the display of pictures, is not the equal of that found in one of the large department stores on Washington Street?

This constantly recurring paradox makes it difficult to escape the suspicion that there is a widespread misconception about the kind of illumination which pictures need. They are not getting it because our engineers do not have the wide experience with pictures, or sufficient sensitivity to their appearance, to make the proper selection for this special task.

Writing in ILLUMINATING ENGINEERING a decade and a half ago, George Ainsworth, who coined that highly irreverent phrase, "The folklore of footcandle engineering," proffered this very wise counsel, "We must learn to think in terms of the ambient brightness of spaces, . . . For high levels of illumination, Nature has provided a light diffused from the atmosphere." This advice is particularly applicable to gallery lighting, but little heed was paid to it then, or even now, because the directed spot light was in fashion and, being an easy way of brightening up gloomy old galleries, it spread like an epidemic through our museums. The spot rendered visible many pictures which had been long hidden from view, and in so doing, led many persons, who should have been more discriminating, to believe that it was really appropriate picture lighting. In a huge, dark cave, like the ground floor of the Los Angeles County Museum, it may well have been the only possible way of presenting the scattered pictures; and one can hardly deny that it is justified in the Louvre, where spot lights are directed almost horizontally over the heads of spectators to illuminate the two Botticelli frescoes from the Villa Lemmi. But thoughtful artists regard this type of illumination only as a useful, economical means of stepping up candlepower in old structures, a temporary expedient, rather than a superior form of permanent picture lighting. Wherever spots or floodlights have been arranged to shine directly down on paintings, without the intervention of any diffusing screen — and that has been the usual form of installation — the illumination has been too directional to give the best appearance to the works exhibited.

The enjoyment of pictures is an aesthetic experience and can not be translated into any precise verbal equivalent, or mathematical formula. A person who spends his time just looking at the paintings will come inevitably to different conclusions from the one who wanders through the galleries taking photometric measurements. It is difficult for an engineer to believe that a lighting installation could be a failure if it met the standard criteria of his profession — if the light were sufficient in quantity, equal in distribution over all the walls, and if the color had been given the best spectral balance. Could anything else possibly be wrong?

To find an answer, it may be profitable to analyze the remodelling of a large gallery in the Carnegie Institute of Pittsburgh, a project which must have met professional standards adequately, because a cross section of its lighting plan was included in that Committee Report on Art Gallery Lighting, which was published by ILLUMINATING ENGINEERING in 1945, and it was termed a "satisfactory installation." Prior to the public viewing of this

AUTHOR: Painter-artist, Westmoreland, N. H.

reconstruction, the advance publicity had been extensive and laudatory, asserting that the mathematical calculations had been worked out so expertly as to provide exactly the same number of lumens for every square foot of wall space. This may have all been quite true, but something else was missing — diffusion. Today this is still the element that is widely absent in artificial illumination, suggesting a failure to recognize that diffusion is just as important a factor in the quality of natural lighting as fine color.

In Pittsburgh, light from the Fresnel lenses overhead beats down unmercifully on the paintings, leaving deep shadows on their upper sections. The light was so nearly vertical that it caromed off the gold frames, making curious yellow streaks on the floor about a yard distant from the walls. The latter had been left in their original dark color, so there was almost no diffusion, and the four-inch shadow covering the upper part of Mary Cassatt's picture was so black that it entirely amputated the woman's hand, painted reaching up to pluck some fruit.

About ten years later this same Cassatt painting was shown in a loan exhibit in New York's Metropolitan Museum, just after that institution had completed a renovation program costing more than ten million dollars, and ending up with the old familiar spot lighting. Under this installation the shadow was only three inches wide, and not quite so dark. This may be progress, but it is not exactly attainment. Almost everyone condemns the shadows cast by frames, but can it be possible they believe that substituting narrow frames, to make the entire canvas surface visible, can completely obviate a bad situation? This is merely removing the tell-tale, very obvious symptom of a malady that is affecting the entire surface of the picture.

The loss sustained by paintings, through something materially less than ideal lighting, may not prove immediately apparent to inexperienced eyes, but high-powered magnification will reveal it to the most sceptical observer. He can see for himself that the roughness of the paint texture, even the grain of the canvas itself, creates a pattern of light and dark which is no part of the artist's intention. Under every lump or projection of paint there will be a dark shadow, and on top there will be a light spot, which, if the surface has been varnished, may be identified as a distorted image of the source of light. The real hue of the pigment is not revealed fully in either these light or these dark spots, and they form, over the entire surface, a slight masking screen, which diminishes the full resonance of color the artist sought to produce.

In less frequent instances, the pattern of the artist's design may be modified by over-directional illumination. Van Gogh's canvas *Thistles*, as displayed in a recent loan exhibit of the Niarchos Collection in the Boston Museum of Fine Arts, will serve as a case history. In the lower part of the canvas the artist chose to express the character of plant growth with many fine, more-or-less parallel, black lines curving upward, but across the central section there were other black lines, running horizontally, which seemed to be without meaning. Closer examination showed them to be entirely foreign to the artist's plan — they were just black shadows under the heavy brush strokes characteristic of his work. Under a more appropriate diffused light they would have been barely noticeable.

It ought not to be necessary to emphasize the fact that the brightness factor of the paint on walls, ceilings and floors is an integral part of any gallery lighting plan, but few problems are more widely ignored. Take the floors for example; tradition has decreed that they be dark, even though entrance vestibules, corridors and rooms in other parts of the museum may have light floors. Probably there may be some light floors in picture galleries, but they are so rare that to cite an example it is necessary to go outside the limits of the Continental United States, to the Academy of Fine Arts in Honolulu, where they are extremely effective in reinforcing daylight in galleries built around a garden patio, receiving light from only one side. In most daylighted galleries, and in many artificially lighted installations, the floor receives more light than any other part of the room. To allow absorption of light by a dark floor is to throw away a very valuable commodity, which becomes more precious when it is reflected upward on the walls, thus contributing to the diffusion.

The brightness desirable for a picture background may be a matter of personal taste, but the reflectance necessary to produce that "ambient brightness," that encompassing light so helpful to paintings, is a less flexible matter, and we dare not set it too low. No matter how much diffusion you may incorporate in your light sources, the reflection from reasonably light paint seems essential in securing a superior quality of diffused illumination in galleries of the sizes and proportions in general use. A very large daylighted gallery is much less affected by this condition — it is more like a slice of outdoors — and painters still speak with regret of the fine light which they enjoyed in the big Vanderbilt Gallery, before the National Academy of Design moved away from 57th Street.

A majority of the walls of our National Gallery are estimated to have an apparent daylight reflectance of between 60 and 65 per cent, and though the

shade is not quite neutral in hue (a little too much toward yellow), it is judged to be an excellent background. A survey was made in an effort to discover how many of the works on view might possibly look better on a lower reflectance wall. No more than a tentative value, statistically, could be assigned as a result of this examination, but it indicated that the existing shade was about equally satisfactory for high-keyed impressionism like Monet's *Rouen Cathedral*, and for the mellow richness of the Italian masters in the Kress Collection. Only one picture, Whistler's big *Girl in White* looked distinctly wrong, and it is probable that its appearance would be more effective on a darker wall, one with as low as 50 per cent reflectance.

An additional item of information was uncovered through the survey. The pale walls gave each artist the fairest chance, each picture seemed sufficiently isolated from its neighbor to communicate its own message. This was not true in those few rooms of the National Gallery which have been ornamented with wood panelling and carved pilasters, in what a mortician might call Circassian walnut. In addition to absorbing too much light, the snuff-colored wood is an unsympathetic background for the paintings, and the molding rectangles force the large pictures up so high that you find a bad skylight glare on the upper portions if you attempt to examine them closely. The works exhibited do not look their best and, though such ornamental rooms may appeal to the tourist trade, they have no place in a truly functional museum.

The current trend is all toward light walls. An extreme in brightness can be found in the temporary quarters of the Guggenheim Museum, where white paint right out of the can seems to have been used, and is useful in improving the uneven distribution of the illumination. A successful color is obtained by placing one white fluorescent tube between two warm ones, but most of the light is dumped in an excessively bright band just above the area where the pictures hang. Why are people so reluctant to use the ceiling as an agency for reflecting the light? This has been done very well in the Perls Gallery, a few blocks further north on Madison Avenue.

Few large museums have been able to rid themselves entirely of fancy-colored walls for at least some of their galleries. In Washington's Corcoran Gallery, some pictures have to do battle with emerald green walls and, in the Boston Museum of Fine Arts, Winslow Homer's great picture *All's Well* struggles for survival on a salmon-colored wall, while its beautiful nocturnal blue coloring is further weakened by a yellow fluorescent light. It has been suggested that fancy walls are injurious, because they reflect upon the pictures a faint tinge of their characteristic hue. It may be granted also that the eye becomes fatigued by a color and is unable to perceive it at full value in the paintings, but the most obvious fault is the conflict created between walls and paintings. Playing a symphony in a boiler factory is just as sensible.

The Metropolitan Museum reopened its renovated rooms with an undiminished number of fancy-colored walls. True modernization was less apparent in the facilities for display than in other directions. The spot lighting, upon which reliance was still placed, was of an elaborate nature, and the pictures were under a barrage of numerous lights aimed in different directions. This variety in angle did not alter the fact that the light all beat down from overhead and remained too directional, too lacking in diffusion to merit an A rating, even in those few rooms where pale walls created some diffusion and mitigated the harshness of the light. The late Francis Henry Taylor, who was Director at the time, was quite traditional in his tastes. He selected for use on the walls some rich-looking imitation brocades in several colors, which may have been intrinsically beautiful, but which reduced the reflective capacity of the surfaces. If his plan was to reproduce settings similar to those upon which old masters had formerly been hung in Europe, there was an ironic twist to it, because at the very same time authentic medieval structures, like the bomb-damaged Palazzo Bianco in Genoa, were being restored with the pale almost monastic walls which, in a television talk, Mr. Taylor dismissed as "antiseptic."

Old masters, even the darker ones, looked much richer and more distinguished on those Italian walls than they did on the red, blue and green brocades in New York. It is encouraging to find that under the Metropolitan's present administration the tendency is toward those "antiseptic" walls which have proved their worth in museums quite as much as in hospitals. Actual progress in the modernization of display conditions has been noteworthy during the last four years.

It is in the evaluation of daylight that the widest divergence of opinion between artist and engineer is found. The latter, as the painter imagines him, is a man who comes out of a museum with no clear recollection of the pictures, but with a copious collection of photometric readings. If it happened to be a day of sun and flying clouds, any daylighted gallery would provide a series of the wildest variations — a grave indictment of natural lighting. Actually, any art lover devoting his time to visual observation can have a very good time on just such a day, taking home with him memories which are

just as rewarding as the instrumental readings were shocking. The experience will be uneven, and during periods of bright sunshine adjustments will have to be made to the great drawback of natural lighting; the one too-light wall and its opposite number which appears too dark. But wait until a big, soft white cloud moves over the skylight, equalizes the light on the walls and fills the room with a beautiful diffused radiance, under which your favorite pictures will give their highest response. Many artists, perhaps most, are willing to tolerate the low valleys of daylight efficiency in order to retain its high peaks of performance at other times. They are not willing to concede that these have yet been equalled by artificial means.

It is obvious that daylight alone will not suffice. Not only at night but often during periods of any day, artificial light must either fill a deficiency or be relied upon to carry the whole load. The two forms of lighting would seem to be normal working partners. However, the authors of *Art Gallery Lighting* not only declared daylight "obsolete," but also went so far as to say, "No satisfactory combination of natural and artificial lighting for art galleries is possible." This sweeping statement was based on the scientifically determined incompatibility of the pair; and because it ought not to work in theory, it was assumed unfeasible in practice. More observation of results, as distinct from theories, shows that it does work successfully in the second floor galleries of our National Gallery. This reasonably happy marriage of natural and artificial light began several years before that Committee Report was published, and although today it may not be the last word in engineering, it is still very much better than the illumination provided in most of our other important museums. The partnership operates so smoothly that few visitors are aware when the shift is made from one to the other.

If daylight is really as obsolete as charged, why has there been so much fumbling in providing substitutes that are as good? Why is the all-artificial light supplied to the newer galleries on the main floor of the National Gallery so greatly inferior to the combination upstairs? Whether measured by an artistic or an engineering yardstick, the large room housing the Gulbenkian Collection would not get a rating better than mediocre, unless you can overlook, in passing through, the spotty illumination of the walls, and the fact that one-quarter of the surface of Guardi's picture *Mira on the Brenta* is covered with a shadow. The spectator does not find himself in real trouble, however, until he reaches that series of rooms used for temporary exhibitions like those from Japan and Korea. As he turns away from examination of the work just to the right of the entrance, his visual acuity is blasted by the spot light which is illuminating it. This is all so unnecessary, because these low-ceilinged rooms would have been ideal for completely indirect lighting, from the ceiling itself in some rooms, or from a curving cove in those rooms which were provided with that.

Much of the criticism to which natural lighting has been subjected is the direct result of a hoary tradition in which the architects used to place implicit credence. This was the belief that a good gallery had to be built twice as high as it was wide. As a result, many structures were too dark, even when there was a fair illumination outside. The late Charles Platt prepared plans for just such a traditional structure for the Art Association of Lyme, Conn., but when the plans were presented there just were not adequate funds for such a lofty building. The height had to be cut in half, with the result that on dark days there is plenty of light, and on bright ones, translucent curtains are drawn. One would hardly know the sun was shining outside. However, the architect was so sure that it was doomed to failure, that it is said that he never visited Lyme to inspect the completed structure, but went on to build the Freer Gallery in Washington. This time, armed with ample funds, he planned a tall building, now generally conceded to have poor light.

In 1944 it was the privilege of this writer to serve as the U. S. observer at St. Margaret's Bay, when the Canadians carried out on the Corvette HMCS *Edmundson* an interesting lighting experiment in which, by focusing an electronic eye on a scanning target, they were able to alter the level of artificial illumination of the entire vessel to match every change in the brightness on the scanning target. Though this demonstration failed to contribute anything of value to our wartime defense measures, its possibilities for the control of daylight gallery lighting were at once apparent. That great drawback, the inequality of brightnesses on the walls in sunny weather, could be corrected with electronic eyes directed on the walls, to screen down excessive light by closing semi-translucent shutters, while at the same time, other eyes were activating relays to turn pivoted panels to increase reflected light where it would help. If the illumination failed too greatly on any wall, the system would bring in the required amount of artificial light.

Complete automation is the secret for a revolutionary improvement in natural lighting and also for smooth integration with artificial illuminant, but few can be persuaded to take any interest in it, because artificial light needs no automation, and daylight has been thrown out the window. We have

long used hand-operated methods of shuttering out unwanted light, but none for increasing light through reflection. Often these devices have fallen into partial disuse, because gallery guards rarely have either the time or the judgment to manipulate them successfully. When it was announced two years ago that the new Clark Art Institute, in Williamstown, Mass., had installed automatic light control, a break in the solid wall of indifference seemed in sight, but the news proved to be incorrect. A visit to Williamstown revealed that control had been improved mechanically, but was in no sense automatic. We continued to mark time, until the Italians stole a march on us, and if reports are accurate, designed full automation through which both natural and artificial lights are successfully controlled and integrated, setting a new standard for high grade picture display.

If the difficulties in handling natural light have been conquered, it will seem that the deliberate decision of the Whitney Museum to exclude daylight from its top floor was premature. However, artists in general have a high admiration for this installation, judging it to be a very superior example of the artificial lighting of pictures. Because of its great accessibility, such a mid-town Manhattan museum performs most easily its functions of education and recreation. Will the museum of the future be a skyscraper or occupy some part of one, in order to profit by a central location? There is nothing to prevent it except our current belief that all of the treasures of any collection should be shown simultaneously. We abandoned that idea long ago in our print rooms, making the thousands of individual items available to any visitor upon request. This is not true anywhere of the surplus pictures, of which every museum has a steadily growing store in the basement. Sometimes the paintings are just stacked against a wall, or they may be hung on immovable screens, wedged so close together that they get little light. They are in better state in the Whitney Museum basement, where 800 pictures can be hung on sliding metal-mesh screens; but when they are brought out into view, neither the light nor the surroundings supplies ideal display conditions, and the public is not expected to view the pictures there.

The development of this same system into genuine *visible storage,* with proper attendants to handle the wants of visitors, would make it possible to house a very large collection in a surprisingly compact building. We need not go as far as to imitate Sir John Soane, who, by ingeniously folding pictures back over each other, managed to get into a very small room in his London town house several hundred pictures, including Hogarth's famous series, *The Rake's Progress.* A modification of Sir John's decision to show paintings in succession may be inevitable as our museums become larger and larger. A rational approach would be to abandon our traditional idea of a "permanent collection," though perhaps one gallery might be devoted to those special favorites which everyone wishes to see, and to those massive altarpieces which are difficult to move around. In other galleries there would be a temporary exhibition of no more than a few hundred paintings, exchanged for a new selection periodically. If a visitor had come from a distance, expecting to see a special painting, he would have just as much right to view it in visible storage as he would to consult a book in a library.

There are many instances where available light is not utilized to best advantage. It would be an excellent thing if, after completing an installation, the engineer were retained as a consultant. The hue or brightness of the walls is too vital a matter to be left to the personal tastes of the Director or the Trustees.

Even in the matter of hanging pictures there is wide disregard of the most elementary of optical principles. Thousands of pictures everywhere are hung too high for their own good, or ours, and it is standard museum protocol to pay homage to large important pictures by building altars or thrones beneath them, to raise them above their fellows. When this elevation puts a glare of reflected light from overhead across the upper part of the canvas, it is either unnoticed or ignored. The simple remedy of lowering the picture is not applied. These errors in judgment involve nothing more profound than that little rule about the angle of incidence and the angle of reflection, which everyone learned in high school, and promptly forgot. If an illuminating engineer were to point out cause and effect, he would get attention, and probably action, from museum administrators. It would be useless for an artist to offer a suggestion, although we have long been aware of the problem. The first artist on record to wage futile battle against the practice, was Thomas Gainsborough who, in 1784, sent a full length portrait to the Royal Academy and attached to it a note, especially requesting that it be hung low.

No attention was paid to his request. In a fury he recalled his picture and never again exhibited in the Royal Academy. His defiance was quite in vain, because the practice of high hanging has endured down to the present day, and Gainsborough is still one of its victims. His portrait of *Lady Rodney* in the Philadelphia Museum is boosted up over a mantelpiece, where it suffers from

bad reflections, and when last seen in San Marino, Calif., his famous *Blue Boy* was shoved up on a wall a few feet, in order to place a bronze below it, supposedly to improve the symmetry on the wall. As a result, it is impossible to get a close-up view of any part of the picture, except the lad's shoes. Although by backing away you may avoid most of the interfering reflection, there is still a slight haze over the upper part, when you are stopped by the opposite wall. No visitor ever sees the *Blue Boy* at its possible best; few are aware of that fact, and still fewer realize why.

There is no reason to believe that museum staffs are any more clearly conscious of reflection damage than is the public. If they were, vigorous steps would surely have been taken. There can be no suggestion of indifference or negligence, because there is a no more earnest, informed, dedicated, professional group than a museum staff. For an explanation we must fall back on the unbelievable capacity of untold millions to look squarely at something and not perceive it. There is nothing that seems to be overlooked more readily and more frequently than the virtual image which has become unrecognizable through partial diffusion. This is true not only in art galleries but all through commercial design and manufacturing, where you will find ill-planned auto instrument panels or television sets, the fronts of which are plastered with shiny brass ornamentation, which may reflect from a window a light ten times as bright as the best white showing on the picture tube. Obviously the buyer does not realize that the quality of his picture is suffering by that competition. Chances are that the manufacturer is equally blind. Some years ago ordinary alarm clocks were made with flat glass faces, and you could stand them at an angle where the face would not pick up any glare from bedlight or window. Today they make them with curving, convex glass, which absolutely insures an interfering reflection at any angle. In an entrance corridor of a technological institute, there is a clock so placed that reflections from glass doorways and a ceiling light unite in making it completely unreadable. To tell time it is necessary to leave the main traffic stream and get close to one of the side walls. When this was pointed out to one of the faculty members, he said with a grin, "We *teach* illuminating engineering here — we don't practice it."

A scattered haze of reflected light from overhead sources may remain unrecognized and ignored when seen on the upper portion of a painting, but when an image is specular enough so that people can adjust their neckties in the glass covering a picture, it receives a lot of attention. The National Gallery was disturbed over collector Gulbenkian's stipulation that the works on indefinite loan must be shown under glass. A partial solution was found through the purchase of half-wavelength glass, which did reduce the interference though, unlike a unilateral gallery with an opaque canopy, it could not eliminate it entirely.

Even when the origin of a reflection ought to be recognized, like the barred pattern of a skylight seen on the lid of a glass-topped case, it can escape notice for an astonishing length of time. For fifty years the Metropolitan Museum allowed the Limoges enamels of Nardon Penicaud to remain under that handicap, though detection, followed by a small expenditure for elevating the pitch of the sloping glass lids, would have caught the reflection of the dark cove overhead instead of the glare of the skylight. The plight of a group of American miniatures in the Boston Museum of Fine Arts is even more deplorable, because the remedy would cost nothing and take but a few minutes. As now placed, the two cases are back to back under a long narrow skylight, but at right angles to it, so that its blinding reflection must fall on the glass, rendering it almost impossible to see the miniatures. Simply rotating the cases one-quarter turn, to make them parallel to the skylight, would probably banish all reflections. If the pitch of the glass were insufficient to do this completely, the cases are individual units, and can be separated, and each pushed a little nearer to the sidewall, where the dark cove overhead would produce no reflection on the glass, thus restoring the miniatures to view. An equally easy correction could be made in the National Gallery, where a seat for visitors has been placed in front of Gerard David's *Ste. Anne Altarpiece*. However, if you sit down, the upper part of the painting is blotted out by skylight reflection. The remedy — move the seat back three feet.

Taken individually, these oversights may seem trivial obstacles to the full enjoyment of a gallery visit, but in the aggregate they assume importance, and many of them can be fixed as soon as detected. Would it not be a good thing if the top museum authorities were to take a periodic refresher course in an intensive study of the appearance of all the treasures in their custody? Wearing the shoes of an ordinary visitor, they might be alerted to some things, which the pressure of administrative duties may push aside. It would be still better if architects, illuminating engineers and everyone else concerned with the problem of picture exhibition were more widely acquainted with paintings. Then the environment most suitable for their display would not be provided without sympathetic knowledge.

# LIGHTING NEWS

## C. A. B. Halvorson Awarded I. E. S. Gold Medal

Illumination's highest honor has been conferred on C. A. B. Halvorson, distinguished pioneer in street lighting developments. The award was made to Mr. Halvorson by unanimous action of Council at its June meeting, acting on the recommendation of the Medal Award Committee, L. E. Tayler, Chairman. Formal presentation of the IES Gold Medal and Certificate, "for meritorious achievement which has conspicuously furthered the profession, art, or knowledge of illuminating engineering" is being made to Mr. Halvorson at the National Technical Conference in Toronto this month.

C. A. B. Halvorson

Mr. Halvorson's very notable contributions and accomplishments in illumination began in 1898 when he was employed by the General Electric Company in their Electrical Testing Department. His early work included the commercial development of the then secret magnetic arc light source, on which he worked in a private laboratory located in the home of Dr. Steinmetz. So impressive was this new street lighting development that by 1911 over 300 cities were lighted by series luminous arc rectifier systems using 4- and 6.6-amp 320-watt and 520-watt sources. In the book "Men and Volts" (pp. 306-307) Mr. Halvorson is credited by his General Electric Associates with having made the magnetite arc lamp commercially successful. From a user standpoint, the magnetite arc represented a milestone of progress because of its high efficiency and long life at a time when the rate of consumption of electrodes required renewal as frequently as every 60 hours. It is significant to note that magnetite arcs were used successfully and continuously in many cities up until recent years, when they were finally replaced by modern sources.

Included in Mr. Halvorson's many developments also are the post-top ornamental luminous arc lamp (for which the term "Great White Way" was coined) and the design of new street lighting luminaires for the then newly developed gas-filled incandescent lamp. In order to overcome the rather yellowish color of this new incandescent light source and to regain the sparkle that was characteristic of the popular "White Way" installations, he developed a self-cleaning prismatic lens. The result of his design is a globe that today has become standard equipment.

The First-Place Medal in arc lamps was awarded to Mr. Halvorson in 1915 for his design and application of 1200 6.6-amp arc lamps used exclusively to floodlight the facades of the beautiful buildings at the Panama Pacific Exposition in San Francisco in 1915.

During World War I, his ability and resourcefulness were sought by the Army in their dire need of a mobile 60-inch searchlight. Starting out with a 7000-pound fixed monster, Mr. Halvorson in 30 days developed a four-wheeled 60-inch light weighing less than 1000 pounds. By designing a special cartridge mechanism he was able to reduce the number of parts from over 1000 to less than 100. His untiring efforts led to the development of a polished metal reflector to replace the costly breakable ground and polished glass mirror formerly employed, and resulted in a searchlight with three times the light output of the previous model. For this development, the U. S. Corps of Engineers presented to Mr. Halvorson a citation for: "Commendable diligence, skill and ability . . . he showed himself to be an energetic and tireless worker, a facile and skillful designer and a collaborator without whose aid the open-type searchlight would have been a futurity."

This development was followed by numerous contributions and patents for equipments in sports, aviation and automotive lighting. He developed a 24-kv projector for airport floodlighting. Allied with his interest in automotive headlighting were many engineering contributions to improve traffic signals. During this same period he was affiliated with Nela Park as a Development Engineer for incandescent lamp equipment. A 900-watt lamp and other projection lamps using a monoplane type of filament construction resulted from this affiliation.

In 1932, Mr. Halvorson was requested by the New York Edison Co. to study lighting conditions in New York City. From this study he developed the "Form 79" luminaire, a globe-shaped unit using a hemispherical reflector of high reflectivity and a prismatic rippled bowl. This unit delivered 55 per cent of the generated light to the pavement, an improvement which tripled the performance of previous designs. It is estimated that well over a million of these units are still in use throughout the country. In the design of the "Form 79" fixture, Mr. Halvorson created the modern pendant-type luminaire, which has since become a standard. Again, from the users' standpoint, the modern pendant unit was a milestone of progress which resulted in higher utilization of light and effective brightness control by virtue of the deep reflector which shielded the filament at high angles. His dramatic introduction of the Sodium Vapor Luminaire was a feature of the IES Conference in Swampscott in 1932. He followed this by research and development into the application of high-intensity mercury vapor lighting.

During World War II, Mr. Halvorson was a consultant to the U. S. Bureau of Ships and the Canadian Navy. The purpose of his work was to determine the

visibility of ships at sea as observed from a submarine. To accomplish this he established a laboratory in Lynn, Mass., working with scale models to duplicate actual conditions. Experimental equipment was finally designed, manufactured and installed on many large cargo and small fighting ships. During the war also (in 1943) he worked with Dr. Coolidge and Dr. Langmuir in Schenectady on the development of an electronic binaural listening device for use by the Coast Guard. Throughout these war years he collaborated with the First Service Command in organizing comprehensive tests to measure sky glow at sea, and served as a member of the Blackout Committee of the Massachusetts Committee on Public Safety.

Mr. Halvorson is, of course, author of numerous IES papers, dating back to 1913, and has presented as well many papers before other Societies. He has been a member of long standing of the IES Committee on Roadway Lighting and is a member also of the American Institute of Electrical Engineers, Society of Motion Picture and Television Engineers, American Society of Municipal Electricians, Society of Automotive Engineers, Lighting Division, and the Essex County Electrical Club.

Since his retirement in 1945, Mr. Halvorson has been employed as a street lighting consultant by the Town of Brookline, Mass., to plan a complete modernization program of the town's street lighting system. An outstanding feature of Mr. Halvorson's plan was the adoption of the IES Type I distribution for all residential streets, which employed an entirely new luminaire developed for this type of application. Brookline adopted the Halvorson plan and with the cooperation of the local utility had it installed over a period of five years, thus becoming the first municipality in New England which is completely lighted in accordance with ASA-IES standards.

## Ten Fellows Elected

Acting on the recommendation of the Board of Fellows, the Council of I.E.S. unanimously elected ten distinguished members to Fellow Grade. This action, taken at the June meeting of Council, elects the following Fellows:

**Carl J. Allen,** Large Lamp Dept., General Electric Co., Cleveland, Ohio.

School lighting in particular is Mr. Allen's specialty, having studied, and published papers on, relative visibility of school tasks; designed lighting units for school applications, and lectured at school lighting clinics across the country.

Secretary of the I.E.S. School Lighting Committee since 1948, Mr. Allen is also Chairman of the Subcommittee on Revision of the I.E.S. Lighting Handbook. He was a contributor to the "Birth and Development of School Lighting" section of the Golden Anniversary Issue of I.E., and has presented many papers before National Technical Conferences.

He has spoken before an estimated 10,000 school superintendents and school board members at more than 30 one-day and 10 three-day conferences at Nela Park. He has addressed innumerable I.E.S. Section meetings and lectured at colleges and universities.

**Svend W. Bruun,** Consulting Illuminating Engineer, Ridgewood, N. J.

Interior and exterior lighting for public buildings has been an important part of Mr. Bruun's career, both at Consolidated Edison Co. of New York, where he designed, among other installations, the spectacular "City of Light," at the New York City World's Fair; and at Rambusch Decorating Co., where as Chief Engineer he was responsible for countless applications of good lighting principles in this field.

During World War II, he carried on considerable research on blackout ventilators for ships, and set up the first and only standards of measurement of performance for these devices, in cooperation with the Electrical Testing Laboratories. In 1957, he left Rambusch to set up his consulting service for public building lighting and the design of special equipment and effects.

An active member of the New York Section, Mr. Brunn has served several terms on its Board of Managers. For six years he was the IES delegate to the Technical Societies Council of New York, for which he also served as secretary and as vice-chairman. As chairman of the New York Section's Committee on Architectural Competition for several years, he revitalized and spread interest in the competition among additional schools of architecture.

On the national level, Mr. Bruun has, since 1954, been a member of the IES Board of Examiners, serving as chairman from 1955 to 1957.

**John M. Chorlton,** Superintendent of Maintenance and Construction, Toronto Board of Education, Toronto, Ont.

Mr. Chorlton's achievements include the initiation of the relighting program in Toronto schools, which has placed them among the best on the continent. He is a long-time member of the IES School Lighting Committee and has been Chairman of it since 1951. He has also been Chairman of the Inter-Society Task Committee on School Lighting of the American Institute of Architects-National Council for School House Construction-IES since 1953. He is the IES Official Representative to ASA Committee A-23, since 1951, and is Chairman of the Canadian Standards Association's Committee on School Lighting.

Jointly with H. F. Davidson, Mr. Chorlton has conducted original research on reflected glare, reported at the Cornell University Research Symposium on Light and Vision in September 1956, and at the Second Research Symposium in March 1958.

He has been Secretary of the Ottawa Chapter and is currently Chairman of the Toronto Section of I.E.S.

**James L. Cox,** Vice-President in charge of Engineering, Duro-Test Corp., North Bergen, N. J.

About 15 patents have been issued to Mr. Cox, pertaining for the most part to fluorescent and high-pressure mercury lamps. For his original work on the development of porous coating for fluorescent lamps, he was, in 1940, given the Modern Pioneer Award. This award was sponsored by the National Association of Manufacturers and was presented to Mr. Cox by Dr. Karl Compton, as "contributing materially to a completely new industry in this country."

Mr. Cox has been a member of the Light Sources Committee and the Progress Committee of I.E.S.

**Hedley F. Davidson,** Chief Engineer, Curtis Lighting of Canada Ltd., Toronto, Ont.

Mr. Davidson has long furthered the principles of I.E.S. through his service on many of its important standing and technical committees. He has been a member of the Papers Committee for many years and has been Chairman since 1956. Publications Committee, National Technical Conference Committee, Committee on School Lighting, Light Sources Committee — on all these Mr. Davidson is active. He is also on the Research Executive Committee of the Illuminating Engineering Research Institute and the Committee on Sources of Visible Radiation of the United States National Committee of the International Commission on Illumination. He has been Secretary and Chairman of the Toronto Section of IES.

Jointly with J. M. Chorlton, Mr. Davidson conducted original research on reflected glare, results of which were presented at the Cornell University Research Symposium on Light and Vision, in September 1956, with further presentation at the Second Research Symposium in March 1958.

He is a member of several committees of the Canadian Standards Association and Canadian Electrical Association.

Carl J. Allen

Svend W. Bruun

John M. Chorlton

James L. Cox

Hedley F. Davidson

Hans U. Hjermstad

Richard N. Thayer

Harold E. Wall

John S. Walsh

Robert L. Zahour

**Hans U. Hjermstad,** Vice-President, Engineering, Sola Electric Co., Chicago, Ill.

Mr. Hjermstad has been instrumental in the development of various constant-voltage and constant-current transformers and constant-voltage direct-current power supplies. In previous work, while at Federal Electric Co., he was responsible for the engineering and design of signal equipment and gaseous discharge lamps.

In addition to his present connection with Sola, Mr. Hjermstad is president of the Electro Seal Corp., which started from his development of an hermetical seal for electrical components, and of Electro-Vac Corp., which does metal evaporation by high-vacuum techniques.

He is a member of ASA Committees C-78 and C-82, the American Institute of Physics, the Institute of Radio Engineers and technical committees of CBM and NEMA.

**Richard N. Thayer,** Manager, Discharge Lamp Design Engineering, General Electric Co., Cleveland, Ohio.

Mr. Thayer has participated in the main General Electric design and development work since it began in 1934. He holds several patents for electric discharge devices, and has supervised research and developments in all types of light sources.

He has presented several papers before National Technical Conferences of I.E.S., which were subsequently printed in ILLUMINATING ENGINEERING. He has also published technical articles elsewhere. He is a member of the American Physical Society.

**Harold E. Wall,** General Superintendent, Public Lighting Commission, Detroit, Mich.

Street and highway lighting has, naturally, been the field of Mr. Wall's contributions, serving the Society since 1955 on the Roadway Committee, of which he is currently chairman, and on many of its subcommittees. He has also served the Michigan Section as Chairman, and is a charter member of the Engineering Society of Detroit, a member of AIEE and is on the Board of Governors of the Electrical Association of Detroit.

Mr. Wall has designed various types of street lighting equipment and participated in extensive tests on specially developed luminaires, which became the basis of the IES Type I street lighting luminaire.

**John S. Walsh,** Director of Commercial Sales, Pacific Gas & Electric Co., San Francisco, Calif.

Mr. Walsh has made contributions in many areas of applied lighting and education in illuminating engineering. He made an investigation into lighting for canning operations which was the basis for the formation of the Cannery Lighting Committee and the establishment of the IES Recommended Practice for Cannery Lighting. A member of the School Lighting Committee, he has presented papers and published articles in that field. He developed standard wall and chalkboard color schemes for classrooms which have been adopted by the State of California School Planning Division. With D. M. Finch and Edward Page, he has worked on a new concept of luminous indirect louverall ceilings.

During World War II, he was Technical Lighting Advisor to the U. S. 12th Naval District and co-author of the West Coast Dimout regulations, advising all branches of the military services, to-

gether with industrial, commercial and public areas on technical methods of sky glow prevention.

Mr. Walsh also served the Society as Director in 1954-1957. He has organized and taught courses and special clinics in illuminating engineering.

**Robert L. Zahour,** Manager, Illuminating Engineering Section of Commercial Engineering Department, Westinghouse Electric Corp., Bloomfield, N. J.

Perhaps of special interest are Mr. Zahour's studies on lighting for plant growth, using incandescent and fluorescent sources, on which he has presented and published several papers. He has also spoken widely on residence, commercial and industrial lighting both to I.E.S. groups and civic clubs, schools and colleges and industrial executive meetings.

Another field in which Mr. Zahour is active is that of lighting for television, having helped in organizing the IES Committee in 1949. At that time also he was appointed to the NBC-RCA Committee No. 6, which studied proper lighting practices for TV studios, which have now become a standard for most networks.

During World War II, as chief engineer for the Newark Safety Council, Mr. Zahour redesigned lighting in New Jersey war plants to minimize spoilage and reduce number of accidents. He was also on the Blackout Advisory Committee in New Jersey.

He has supervised and lectured at the New York Section's annual courses on Fundamentals of Illumination from 1951 to 1957. He has recently been elected Chairman of the newly-organized New Jersey Section.

# Great Lakes Regional Conference

**Date:** June 23-24, 1958
**Place:** Hotel Sheraton, Rochester, N. Y.
**Attendance:** 170

Technical program, MMILJ contest, banquet — all of the usual ingredients were included in this year's Great Lakes Regional Conference. Typical of this Region, however, is the "national conference" treatment given each phase of its program, greatly to the benefit of those attending. To wit:

### Technical Program

Each session had a discussion organizer who acquainted himself beforehand with the subjects of all the papers in his session, and arranged for appropriate discussors. This leavening ingredient to a presentation provides a most stimulating experience for the listeners, whether the talk be technical, semi-technical or strictly application. Further, canny planning had gone into the program to present a nicely balanced fare of technical developments, material and equipment developments, and new approaches to application. In planning the program and garnering the speakers, emphasis was obviously on presentation of the hottest subjects in lighting shop-talk. Again to wit: The new approach to footcandle recommendations with a summary of the Blackwell researches. What's new in light sources. High output fluorescent lamps — indoors and out. The status of high frequency systems. New materials for the control of light. Trends in show window lighting, and new approaches to lighting for auto sales.

Alston Rodger's demonstrations of lighting phenomena were a nice change of pace. These are full of "Gee-Whiz" items with an element of entertainment as well as education. Another fillip was the panel discussion which pitted three lighting industry men (lamp, fixture and ballast) against architect, consulting engineer and user. Debate procedure brought pet gripes into the open for the highly educational treatment of open discussion.

### MMILJ Contest

Here again the virtues of good organization were proved. The contest at Great Lakes was considered a major feature worthy of advance planning and the best chairman available. Earl Domoney was chairman. He, it may be remembered, was the winner of the Society's first national contest back in 1952. It went like clockwork, with a total of nine excellent entries, six on Class II, three in residential.

*Commercial Entries*

First Prize: Clifford Crookes, Northwest Ohio Section.

Second: V. C. Aderente, Michigan Section.

Third: Tie between Harold J. Gruber (R. W. Brown, proxy), Ohio Valley Section, and Lewis L. Nurnberger, Western Michigan Section.

Runners-up: R. C. Brosius, Cleveland Section, F. A. Kalil, Central New York Section.

*Residential Entries*

First Prize: Joint entry by Martin Klein and Lucille Hanratty, Cleveland Section.

Second: Anthony Fodell, Michigan Section.

Third: Scott Nagel, Northwestern Ohio Section.

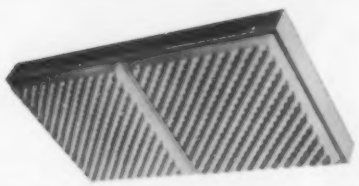
### Banquet

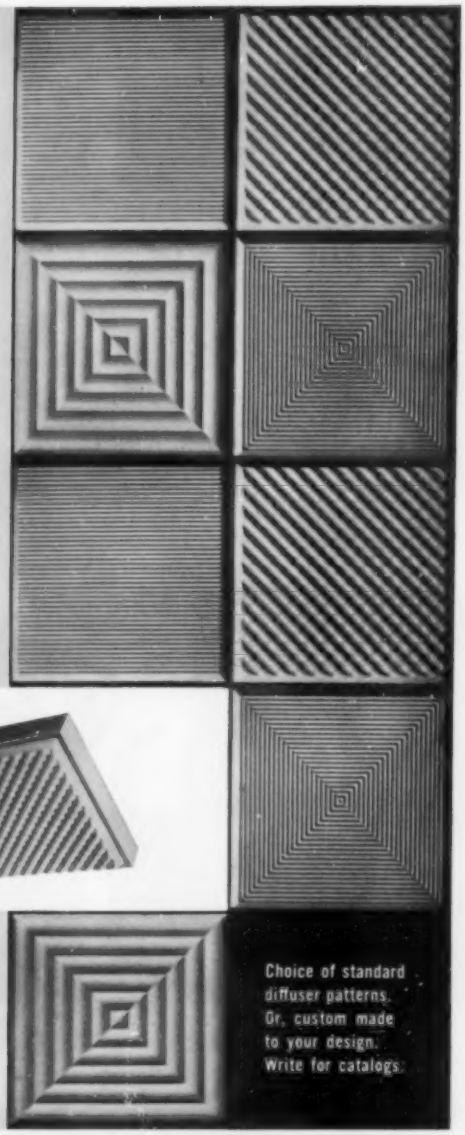
Rochester IES wives, as well as several talented committee men, added a typical Great Lakes touch to this affair. All the flowers, for example, were home grown in members' gardens, cut and collected by the ladies committee, and beautifully arranged by its members. This applied also to fresh flowers supplied daily throughout the conference to the suites of the President, Vice-President and other visiting notables. Even the flower holders and vases were hand-fashioned from simple containers. The unusually

(*Continued on page* 13A)

**HOSTS to 170 delegates at Great Lakes Regional Conference were Norman Kridel (seated), Chairman of Rochester Section, and Robert Taylor, Regional V-P, who addressed the opening session.**

# THIS IS THE FIXTURE THAT IS STILL FIRST CHOICE



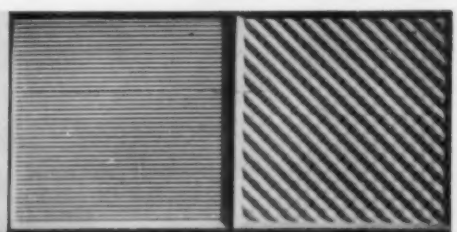


Choice of standard diffuser patterns. Or, custom made to your design. Write for catalogs.

All-Brite
LIGHT OF THE WEST

# AREA/LITER®

Engineers who specify AREA/LITER® stay with AREA/LITER®. Invented and perfected by All-Brite AREA/LITER® is America's most widely installed surface or recessed modular fluorescent fixture.



®Registered by Fluorescent Fixtures of California

FLUORESCENT FIXTURES OF CALIFORNIA
352 SHAW ROAD
SOUTH SAN FRANCISCO, CALIF.

PLANTS ALSO IN LOS ANGELES: PORTLAND, OREGON: AND VANCOUVER, B. C., CANADA.

THE MOST IMPORTANT COMPONENTS
IN A JEFFERSON FLUORESCENT BALLAST

## *CAN'T BE DUPLICATED*

They're Jefferson's seasoned salesmen and engineers who specialize in helping to solve *your specific* ballast problems. Members of this largest, most experienced team in the industry are located near you and awaiting your call. They are your guarantee that whichever Jefferson ballast you use . . . it will be the *finest you can use.*

**Jefferson** FLUORESCENT BALLASTS
JEFFERSON ELECTRIC COMPANY • BELLWOOD, ILLINOIS

(Continued from page 10A)

beautiful floral display nicked the conference budget for a total of $5.00 — not counting the hours of faithful work devoted to it.

Further ingenuity had gone into the banquet-hall decorations (see cut). This is familiar Great Lakes practice, an added ingredient which ever sparkles their dances. During dinner (another typical touch in this Region) the group was entertained by the Men's Chorus of the Rochester Gas and Electric Corp. Their director was Raymond J. Hasenauer, accompanist was Herbie Zahn.

Regional Vice-President Robert Taylor presided at the banquet. Some of his pleasant duties included introducing President Reid, presenting the MMILJ awards amidst wild applause from the Toledo and Cleveland contingents, and presenting a gift to President and Mrs.

(Continued on page 16A)

**Technical Program — National speakers were a prominent feature of the Great Lakes technical program. Examples:**

**G. J. Taylor, I.E.S. President-Elect, and Alston Rodgers, General Electric.**

**Ted Sargent, Sylvania, and Bill Johnson, Westinghouse.**

**E. W. Beggs, Westinghouse Lamp Division.**

**Jim Finn, Detroit Edison, and Gene Rae, Holophane, New York.**

**C. L. Crouch, I.E.S. Technical Director.**

**Pro and Con. Panel, at right, three lighting representatives rebut the discussions of architect, user and consulting engineer, photo at left. Participants in this lively session: (left) architect Alan Macomber, user H. S. Glick, consulting engineer R. E. Cherne; (right) lighting men William Johnson, J. S. Frizzel, Quentin Dobras. Les Twichell was moderator of the panel discussion held at the Tuesday afternoon session of the Conference.**

# SHEFFIELD ANNOUNCES FIRST GUARANTEED LIGHT STABLE* STYRENE PLASTIC DIFFUSERS

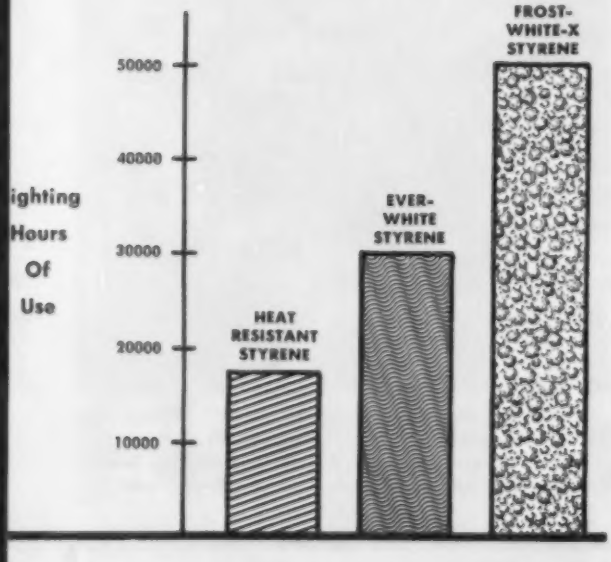
## Frost-White-X† diffusers now guaranteed against discoloration for 50,000 lighting hours

You can now obtain styrene shields and pans for fluorescent fixtures that not only have outstanding resistance to breakage and extreme flexibility, but are backed by a written guarantee against excessive discoloration for 50,000 lighting hours!!

The result of a 2-year development program, Sheffield's Frost-White-X styrene is the first to be so guaranteed. Exhaustive laboratory tests have established its light stability and made it possible for Sheffield to issue this guarantee.

In addition, Frost-White-X diffusers have a non-reflecting surface finish, will not become brittle with long use and can be colored to match your requirements.

† TRADE MARK




Light stability of FROST-WHITE-X diffusers is more than twice that of heat resistant styrene diffusers.

**Fixture Designers and Manufacturers**

Frost-White-X diffusers permit you to:

1. Guarantee their light stability.
2. Use economical styrene diffusers instead of acrylic or glass.
3. Eliminate practically all breakage in shipping and handling.
4. Cut material costs by reducing diffuser cross-sections.
5. Simplify fixture design and assembly.

**Architects**

By specifying Frost-White-X diffusers or pans you can:

1. Avoid degradation and put lasting quality and appearance into lighting fixtures.
2. Minimize fixture cost without sacrificing performance.
3. Improve lighting efficiency.
4. Simplify cleaning and maintenance.
5. Increase design possibilities.

SHEFFIELD PLASTICS, INC.
FROST-WHITE-X
Light Stability
GUARANTEE
Plastic shields, diffusers or pans made with Sheffield Frost-White-X polystyrene are guaranteed to withstand 50,000† lighting hours in fluorescent fixtures without discoloration due to ultra violet light in excess of 20 points**, as measured by the test procedure outlined by the IES-SPI-NEMA Subcommittee of the Light Control and Equipment Design Committee of the Illuminating Engineering Society in its report, dated February, 1958, on "Recommended Light Characteristics of Polystyrene Used in Illumination."
This guarantee shall apply to all Frost-White-X material used under the following conditions.
1. The "X" (coated) side of the plastic shall be placed adjacent to and at least 1" away from the fluorescent tubes.
2. The fluorescent tubes used shall not exceed 60-watts in standard white, standard warm white, standard cool white, daylight or equivalent, types.
3. The average temperature of the plastic in use shall not exceed 110 F.
Any shields or pans made with FROST-WHITE-X polystyrene which fail to conform to the terms of this guarantee, will be replaced free of charge, under conditions identical to the original contract, upon submission to Sheffield Plastics of proof – including samples of the faulty plastic – that the original shields or pans failed to meet the conditions of this guarantee.
†50,000 lighting hours, for reference purposes, is equivalent to approximately 15 years of lighting use based on exposure for 10 hours per day, 6 days per week.
**Specimens examined with spectrophotometer for degree of yellowness in accordance with Luminous Reflectance and Color of Materials (ASTM D791) and the following equation.
Yellowing Factor = 100 (T420 – T420) – (T680 – T680)
T560
where
T420 = % transmission of same thickness of unexposed material at 420 mu.
T'420 = % transmission of specimen at 420 mu.
T680 = % transmission of same thickness of unexposed material at 680 mu.
T'680 = % transmission of specimen at 680 mu.
T560 = % transmission of same thickness of unexposed material at 560 mu.
LIGHT STABILITY GUARANTEE
50,000 LIGHTING HOURS
FROST-WHITE-X
polystyrene
SHEFFIELD PLASTICS, INC.
SHEFFIELD MASS
SHEFFIELD PLASTICS, INC.
SHEFFIELD, MASS.

* The Sheffield Guarantee of Light Stability — given to every user of Frost-White-X diffusers and sheet material — *guarantees replacement* of any Frost-White-X fluorescent fixture component which exhibits more than 20 points of yellowness** after 50,000 lighting hours.

** As defined by the Light Control and Equipment Design Committee, Illuminating Engineering Society.

Break-resistant FROST-WHITE-X shield easily withstands bend around circline lamp.

## WRITE FOR COMPLETE DETAILS

**Sheffield Plastics Inc.**
**Section 82-B**
**Sheffield, Mass.**

..... Send details on your Frost-White-X guarantee of light stability.
..... Send technical data on Frost-White-X diffusers.
..... Have your representative call.

Name ..... Position .....

Company .....

Street .....

City ..... Zone ..... State .....

FIRST IN PLASTICS FOR LIGHTING

# SHEFFIELD PLASTICS

INC.
SHEFFIELD, MASS.

**REGIONAL organization of a high order developed for Great Lakes one of the Society's most successful MMILJ contests. Chairman responsib'e for this was Earl Domoney, at left in front row. Contestants next to Mr. Domoney in front row, Fred Kalil, Anthony Fodell, Vincent Aderente, Lucille Hanratty, Martin Klein. Back row: Lewis Nurnberger, R. W. Brown (proxy for H. J. Gruber), R. C. Brosius, Scott Nagel, George Warner and Clifford Crookes.**

**JUDGES, Class I, MMILJ — George Taylor, I.E.S. Vice-President; Ruby Redford, I.E. Editor; C. E. Waldron, Northeastern Regional V-P.**

*(Continued from page 13A)*

Reid from the Great Lakes Region. This was a piece of the incomparable Steuben ware, made within the Region at Corning, N. Y.

The banquet was, of course, *the* social event of the Conference. However, there were additional plans for the large group of ladies attending (some 50). Their program was under the direction of Mrs. Bruce Thompson and Mrs. Homer Locke, and included a Get Acquainted Brunch the first day, a bus tour of Rochester Parks, a conducted tour of the George Eastman House, with luncheon at Treadway Inn. This last was especially nice, with favors and door prizes for all. During luncheon the ladies were entertained by two very talented IES member pianists, Mrs. Frederick Vanderlinde and Mrs. Lawrence Gruman.

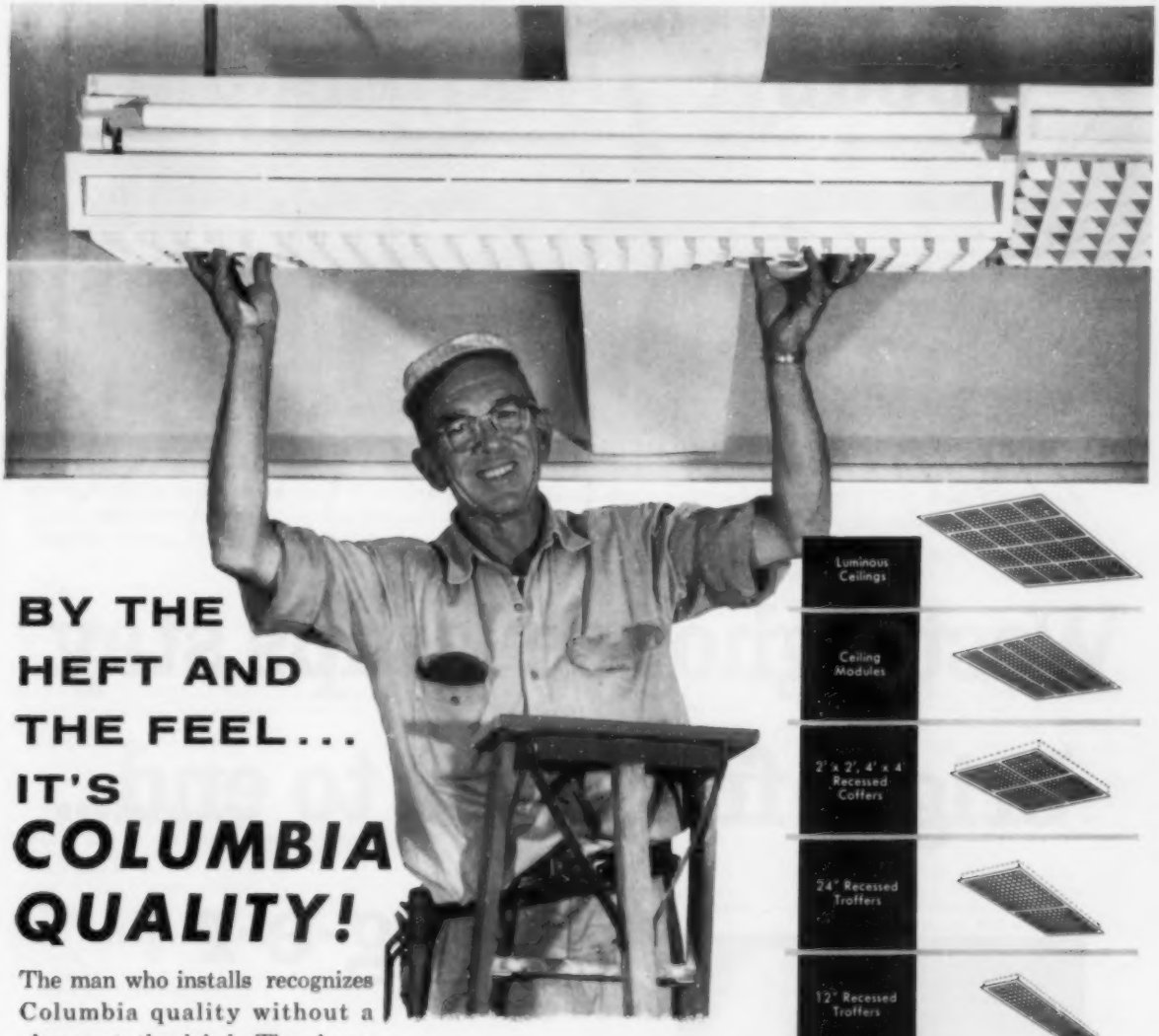
Other features of the Great Lakes Regional included the President's Luncheon on Tuesday, with President Kirk Reid as speaker, and a Local Activities Committee meeting Sunday evening, preceding the conference. This meeting was distinguished by the presence of incoming and outgoing national Presidents (Kirk Reid and George Taylor), ditto Regional V-P's (Bob Taylor and Bob Brown), and 23 officers of all the Great Lakes Sections and Chapters for both 1958 and 1959 administrations. Several major items on their agenda included discussion of the possibility of creating a new IES Region from a geographical east-west split of the present area. This was not settled, but the site of the next two conferences was. In 1959, Buffalo, N. Y.; in 1960, Cleveland.

### Program

The program in detail, for the record, was as follows:

*(Continued on page 19A)*

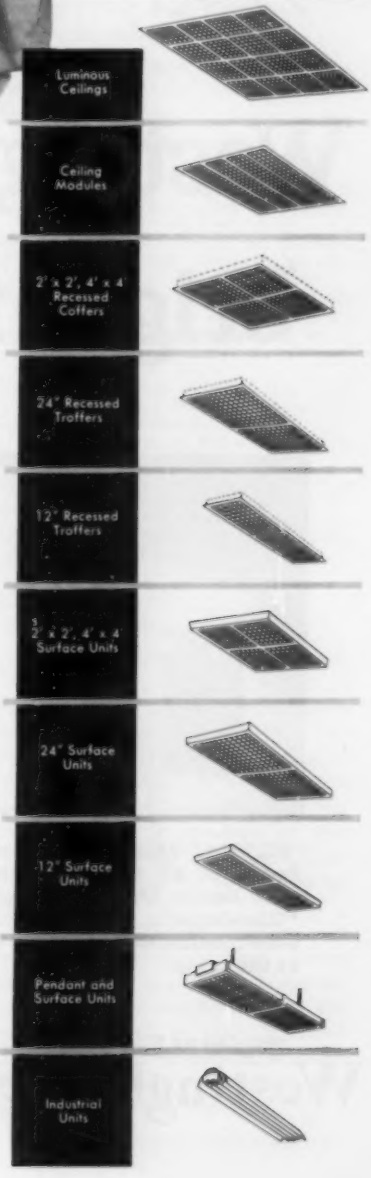
**HEADED for Toronto: Clifford Crookes, MMILJ Class II winner (photo at left), and Lucille Hanratty (photo at right), Class I winner. Great Lakes Regional Vice-President Robert Taylor presented the awards.**



# BY THE HEFT AND THE FEEL... IT'S COLUMBIA QUALITY!

The man who installs recognizes Columbia quality without a glance at the label. There's no wobble, shimmer or shake. Every Columbia fixture is solid and strong . . . built to install with ease and last a lifetime.

The engineer and contractor know that Columbia means economy, too. The price is right and the quality is the best . . . a fine combination for satisfaction on any job. Columbia manufactures a complete line of fixtures ranging from 2′ x 2′ coffers to acres of luminous ceiling; recessed, surface and pendant mounted and with a wide selection of shielding media and diffusers. Our catalog and price list tell the story. *Send for them today.*

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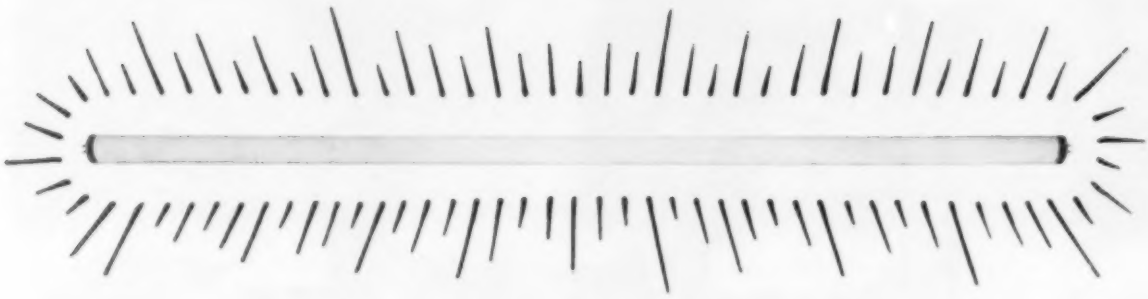
# Goodbye, "Dead-Ends"!



# Westinghouse lamps stay bright from end to end...

# l-o-n-g-e-r !

New Westinghouse chrome vanadium alloy leads reduce end blackening—keep lamps bright end to end longer.
WESTINGHOUSE
40W COOL WHITE
U S A

**"ULTRALUME" phosphors coat the inside of all Westinghouse fluorescent lamps. Only Westinghouse has "Ultralume"...the phosphors that assure maximum brightness for the life of the lamp.**

Banish light-robbing, unsightly "dead-ends" on your fluorescent lamps. Next time, use Westinghouse lamps with exclusive "Ultralume"™ phosphors and new chrome vanadium alloy leads. The combination of revolutionary new leads and Ultralume phosphors make Westinghouse lamps give maximum light longer and keep them bright end to end!

Save money, too! Lamp for lamp, Westinghouse fluorescents give more light for the same wattage. You get more light per foot . . . more light per dollar!

Specify Westinghouse on every lamp order. Call your local authorized Westinghouse agent or write—Westinghouse Lamp Division, Bloomfield, N. J.

YOU CAN BE SURE...IF IT'S

**Westinghouse FLUORESCENT LAMPS**

**TYPICAL of the preparation which invariably goes into Great Lakes conferences is this decorative treatment at the banquet. Panels are luminous, with red luminous plastic letters and colorful connecting panels listing the Sections and Chapters in the Region.**

*(Continued from page 16A)*

**Monday, June 23, Morning Session**

Welcome by Conference Chairman — Norman Kridel; Regional Vice-President — Bob Taylor.
My Most Interesting Lighting Job Contest.

**Afternoon Session**

What's New in Light Sources — E. W. Beggs, Westinghouse Electric Corp.
Design and Application of Higher Output Fluorescent Lamps — R. D. Churchill, General Electric Co.
Facts of Light — Alston Rodgers, General Electric Co.

**Monday Evening**

Cocktails.
Presidential Reception and Banquet — Entertainment — Dancing.

**Tuesday, June 24, Morning Session**

New Footcandles from the Research Program C. L. Crouch, Technical Director, I.E.S.
Prismatic Control of Artificial Light with Plastic Material — Gene G. Rae, Holophane Co. Inc.
Trends in Show Window Lighting — J. S. Frizzell, Pittsburgh Reflector Co.
Lighting for Auto Sales — J. F. Finn, Detroit Edison Co.
President's Luncheon.

**Afternoon Session**

Outdoor Lighting Application of Higher Current Fluorescent Lamps — T. C. Sargent, Sylvania Electric Products Inc.
The Status of High Frequency Systems for Lighting — W. H. Johnson, Westinghouse Electric Corp.
Panel Discussion: User, Architect, Engineer vs. Lamp, Fixture, Ballast.

COMMITTEES

| | |
|---|---|
| Vice-Pres., Great Lakes Region | Bob Taylor |
| General Conference Chairman | Norm Kridel |
| Vice-Chairman | Homer Locke |
| Secretary | Miss Melrose Franklin |
| Program and Papers | Les Twichell |
| Finance | Roy Conheady, Treasurer; Ted Ey; Art Principe |
| Hotel | Bill Barclay |
| Lighting, Display and Decoration | Floyd Owen |
| Transportation | Ed Zdenek |
| Registration and Reception | Cal Kellogg |
| Attendance and Publicity | Fred Elley |
| Ladies | Mrs. Bruce Thompson; Mrs. Homer Locke |
| Entertainment | Bruce Thompson |

**GIFT to the Reids — Steuben glass bowl, one of the Region's most beautiful products.**

## British I.E.S. Plans Tours For Jubilee Celebration

In 1959 the Illuminating Engineering Society of Great Britain will be celebrating its Golden Jubilee, and a number of special functions will be held in London and other cities. One plan, now well advanced, is for members from other countries to share in the celebrations. A series of special visits is scheduled to take place on June 11, 12 and 13.

Places to be visited in London include: research laboratories, television studios, installations in new offices and shops, the Houses of Parliament, London Airport and recent floodlighting and street lighting installations. This series of visits will provide an opportunity for visitors from other countries to see places which are not normally open to them, and to see some of the newest and most outstanding developments in British lighting in the company of the individuals personally responsible.

Those interested in taking part in this series of visits are asked to communicate with the Secretary, Illuminating Engineering Society, 32 Victoria Street, London, S.W. 1.

## Annual Milwaukee Conference — Theme Is Industrial Lighting

The ninth annual spring Lighting Conference was held in Milwaukee, Wis., May 23, at the Engineers Society of Milwaukee Building. Attendance totaled 126. Program and speakers:

Good Office Lighting Is a Good Investment — Eric Church, Lighting Products, Inc.
Outdoor Lighting for Parking and Protection — Wallace W. Weld, Revere Electric Mfg. Co.
How to Unhazard Hazardous Areas — Harold N. Levin, Crouse-Hinds Co.
Light Sources That Have Come of Age — Richard M. Smart, Sylvania Electric Products, Inc.
What You and Your Neighbors Are Doing Now in Lighting — Charles N. Laupp, Wisconsin Electric Power Co.
A Look into the Lighting Future — Quentin E. Dobras, General Electric Co.
Importance of Cost Analysis with Regard to System Design — Theodore Summers, Jr., Westinghouse Electric Corp.
Benefits of Good Lighting—Quentin E. Dobras, General Electric Co.

## ASHAE and ASRE Consider Merger

In a joint statement issued by the Councils of the American Society of Heating and Air-Conditioning Engineers and the American Society of Refrigerating Engineers, it has been announced that they have approved in principle a method of merging the two societies. ASRE members, in attendance at their 54th annual meeting authorized submission of this proposal for balloting by the membership.

E. R. Queer, ASHAE President, and Cecil Boling, ASRE President, further announced that present plans contemplate that the proposal for a merger and proxy ballots will be officially mailed to members of both societies in late October. Full particulars of the merger plan will be circulated by September.

*(News continued on page 20A)*

**GREAT day for the Reids (center). President Kirk M., and Regional V-P Kenneth Reid discuss program schedule with Jack Cottingham (left) and Conference Chairman, Walter E. Potter, right. *Electrical West* photo.**

**NEWLY-inducted member of Portland Rainmakers, Kirk Reid receives sample of Portland rainwater to insure lush growth of his Ohio tree farm. This bit of hi-jinks, joint luncheon with Oregon Electric Club.**

# Pacific Northwest Regional Conference

**Date:** May 22-23, 1958
**Place:** Multnomah Hotel, Portland, Oregon
**Attendance:** 200

Traditionally an area for high-level IES meetings, this year's Pacific Northwest Region lived up to its reputation in the over-all value of its Conference program. Four sessions scheduled an interesting balance of trends in lighting, with application ideas and new materials—all of it educational. (See detailed program at end of this report.)

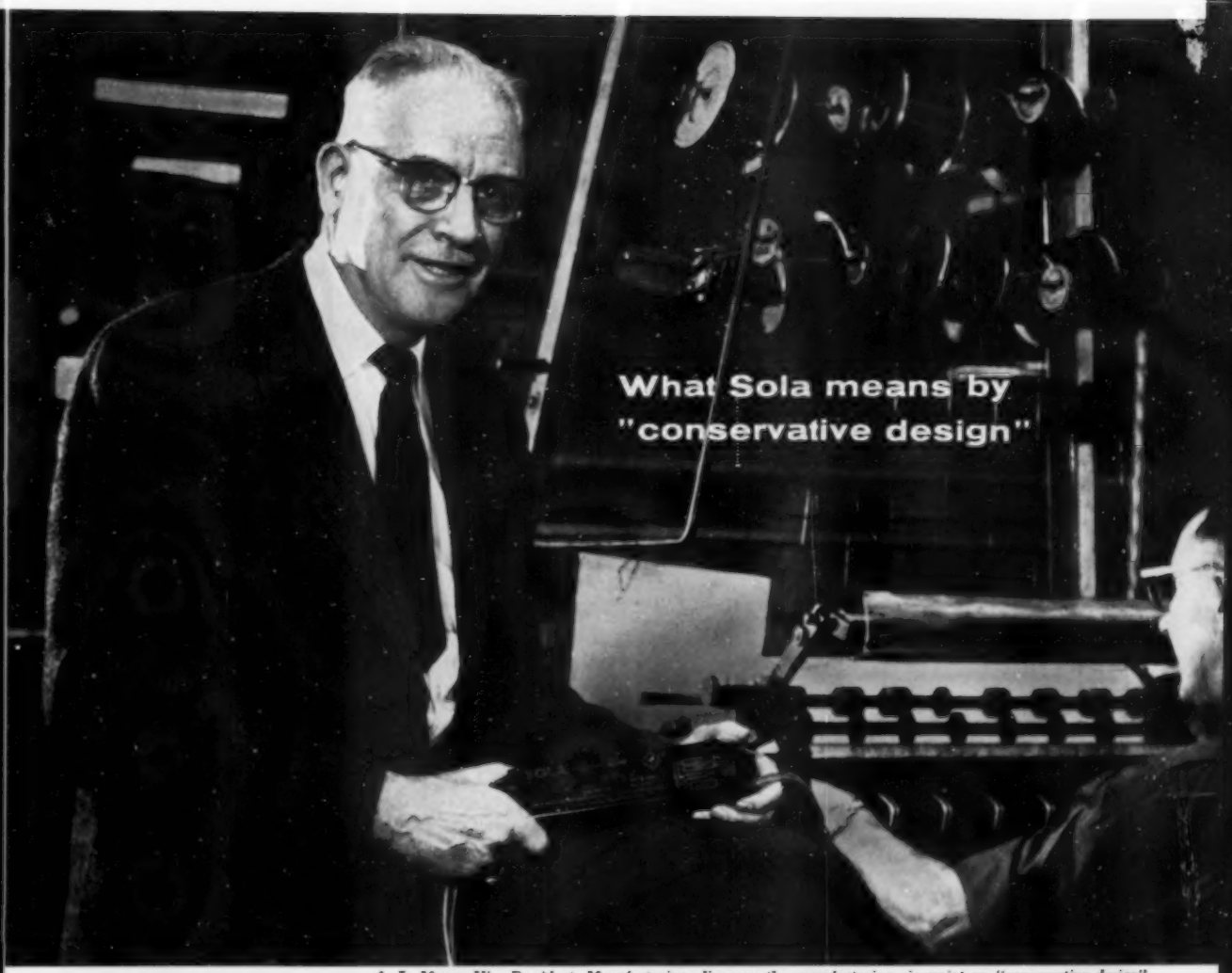
All of the subjects presented were particularly apropos of the lighting problems encountered in the northwest, for example, the availability of daylight in school classrooms. Results of a year's study of this were presented by Beverly Travis, Seattle consulting engineer (and incoming Regional V-P). His work on classroom daylight, still underway, aims to determine the minimum daylight requirements for different types of classrooms. Readings taken over a year's period are being correlated with studies of natural light conditions in schools of the Pacific Northwest. Of immense interest to his Conference audience, Mr. Travis considered his presentation merely a progress report on these continuing studies, with a full and formal report still to come.

Another subject close to the interests of Nor'westers was the discussion of Portland's "million dollar a year" street lighting program, by Carl H. Lundell, city electrical engineer. This is claimed to be the largest and most elaborate modernization program ever undertaken by a city, eventually taking in some 1200 miles of city streets. Extensive as it might be, the City Fathers were convinced of its value following a study of Portland accidents this year as compared to the preceding three. Since the modernization was begun, nighttime accidents in Portland are down 30 per cent, even against an upward trend in number of accidents shown by a 9 per cent increase of daytime accidents.

Ballasts, of course, are ever a hot subject, whatever the area. On the Pacific Northwest program, this subject was covered by Fred W. Abrahams, Advance Transformer Co., Chicago, who discussed new developments in fluorescent lamp ballast design. A special new problem, he

*(Continued on page 23A)*

**LARGE attendance (over 200) attested to importance of IES Regional Conference in Portland May 22-23. This view, a luncheon session.**




*A. L. Myers, Vice President, Manufacturing, discusses the manufacturing viewpoint on "conservative design"*

# "At Sola, we top our own engineers' specs in the manufacture of fluorescent ballasts"

When Sola engineers put a set of specifications on paper, it's our production department's job to turn out a ballast that measures up in every respect.

We've developed what we think is a pretty sure-fire method of accomplishing this. While it's true that Sola fluorescent ballasts are designed and built to surpass CBM standards, we in production build them to exceed even Sola's own specifications by a wide margin of safety.

Highly-trained employees utilizing special equipment, close inspection by competent supervision, and rigid quality control of raw material give us assurance that "we're meeting specs and then some." This is what we mean by the conservative design of Sola ballasts.

As a result of this "extra effort" in production, you can be sure you get what you pay for when you specify Sola fluorescent ballasts.

*Write for "An Analysis of Fluorescent Lighting System Costs," Report 3H-FL-281*

Sola Electric Co., 4633 W. 16th St., Chicago 50, Ill., Bishop 2-1414 • Offices in principal cities • In Canada, Sola Electric (Canada) Ltd., Canmotor Ave., Toronto 14, Ont.

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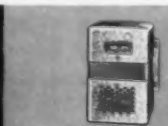
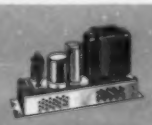
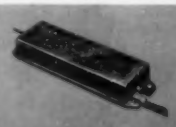

CONSTANT VOLTAGE TRANSFORMERS


REGULATED DC POWER SUPPLIES

MERCURY LAMP TRANSFORMERS


FLUORESCENT LAMP BALLASTS

# NEW! and packed with profits!

## the virden Sunshine® Ceiling

V-8046. Complete packaged ceiling $73.25 list. Slightly higher west of the Rockies.

### A 4′ x 6′ "Packaged" Unit for Bathrooms, Kitchens For New Homes...Old Homes...Modernization

The new Virden Sunshine Ceiling.* A complete packaged unit that installs quickly and easily to any ceiling surface. Electrical channel system fastens to ceiling — satin white suspended grid holds plastic diffusers (8½" drop). Uses six 100W incandescent lamps to flood the room with even, glare-free "sunshine". A sure-fire sales clincher in new homes. A terrific plus-profit maker for use in existing homes or on modernization jobs.

Luminous ceilings promise to be the next big development in home lighting. Virden brings it to you now in a complete easy-to-install package. Plan now to use it in your next job, new or old. See the model now on display at your Virden distributor, or write John C. Virden Co., Dept. IE, 6103 Longfellow Ave., Cleveland 3, Ohio.

**virden**

Member American Home Lighting Institute

* Patent No. 2,659,807

(Continued from page 20A)

said, arises from the current trend toward lower ceilings with recessed fixtures. Audience participation was brisk, following this discussion. Pet peeves: ballast life, ballast trouble, ignorance of the fact that fixtures cannot be surface-mounted against combustible ceilings.

Lighting levels may be lower in Europe, said John E. Baker in his talk, but their lighting design shows more esthetic imagination than ours. His beautiful slides of remarkable lighting installations in Europe proved his point well.

Model room demonstrations for office lighting were an interesting "visual education" device shown by Chester Jarrett, Portland General Electric Co. The models demonstrate the typical "before" conditions of many offices. A most convincing transformation is made, during the 30-minute demonstration, the "remodelled office" having light walls and furniture, properly balanced reflectances and controlled brightness.

My Most Interesting Lighting Job contest occupied two sessions of the Portland Conference. Winners, for which First will represent the Region at Toronto are:

CLASS I: RESIDENTIAL

First Prize — Mrs. Grace Schoeni, Portland General Electric Co.

Second — E. Naumayer, Portland General Electric Co.

CLASS II: COMMERCIAL

First Prize: A. G. Drapes, Great Falls, Montana.

Second — Miss Jane Robison, Consultant, Oregon Section.

Third — D. E. Holland, M. A. Thomas Co., Consultants, British Columbia Section.

President Reid was guest speaker at a joint luncheon with the Electric Club of Oregon, opening day. He was further honored by a reception and the President's Banquet the following evening.

The complete program included:

Conference Opened by Jack T. Cottingham, Oregon Section Chairman.

### May 22, Morning Session

Chairman, Martin Vickers, Chinook Chapter.
Response, Kirk Reid, National President of I.E.S.
New Basis for Footcandle Recommendations, C. L. Crouch, Technical Director, I.E.S., New York, N. Y.
How Much Daylight Is Enough, Beverly A. Travis, Consulting Engineer, Seattle, Wash.
Fluorescent Street Lighting, L. E. Ryan, City Electrician, City of Vancouver, B. C.
Joint Luncheon — I.E.S. – Electric Club of Oregon, Empire Room.
The Place of Lighting in Electrical Industry, Kirk M. Reid, National President, I.E.S.

### Afternoon Session

Chairman, Jack M. Connauton, Edmonton Chapter.
A Planned Street Lighting Program — Carl H. Lundell, Electrical Engineer, City of Portland, Ore.

**LADIES luncheon was held at historic Kamm estate. Pouring, Mrs. Ken Reid, left, Mrs. Kirk Reid, right.**

Ballasts and Circuits for Fluorescent Lighting — Fred Abrahams, Assistant to Vice-President, Advance Transformer Co., Chicago, Ill.
Extremely High Output Lamps and Applications — Willard C. Brown, Director of Lighting Education, Lamp Department, General Electric Co., Cleveland, Ohio.
Lighting Trends in Europe — John E. Baker, Vancouver Lighting Ltd., Vancouver, B. C.

### May 23, Morning Session

Regional Activities Breakfast.
Chairman, John Morrison, Vancouver Island Chapter.
Seeing Environment in Offices — Demonstration — Chester W. Jarrett, Lighting Director, Portland General Electric Co., Portland, Ore.
I.E.S. Progress Report — National Technical Conference — James H. McCulloch, Independent Testing Laboratories, Boulder, Colo.
My Most Interesting Lighting Job Contest — Frank H. Miehe officiating.

### Afternoon Session

Chairman, P. F. Fletcher, British Columbia Section.
My Most Interesting Lighting Job Contest.
Plastics in Lighting — W. H. Kahler, Westinghouse Electric Corp., Cleveland, Ohio.
Life and Light Behind The Iron Curtain — Mr. and Mrs. W. P. Lowell, Jr., Sylvania Electric Products, Salem, Mass.
Reception and No-Host Cocktail Party.
President's Banquet.
Address by President Kirk Reid, Cleveland, Ohio.

**PORTLAND roses to Mrs. Reid, from Queen of Portland Rose Festival.**

### LADIES PROGRAM

### May 22

Reception and Tea, Pacific Power and Light Co. Auditorium.
Nude With Violin — Presentation by Dr. Charles Gaupp, Assistant Professor of Drama, Portland State College, Portland, Ore.

### May 23

Tour of Kamm Colony.
Luncheon.
Life and Light Behind The Iron Curtain — Address by Mr. and Mrs. W. P. Powell, Jr., Sylvania Electric Products, Salem, Mass.
Reception and Cocktail Party.
President's Banquet.

### COMMITTEES

General Chairman ..... Walter E. Potter
Finance & Budget ..... John A. Schulter
Lighting Contest ..... Frank H. Miehe
Banquet & Entertainment ..... A. B. Evans
Registration ..... Robert D. McCain
Hotel Arrangements ..... Marvin S. Prestwood
Publicity ..... Fred A. Farley
Properties ..... D. A. Maulding
Reception ..... D. E. Seely

### LADIES COMMITTEE

Mrs. D. E. Seely
Mrs. J. T. Cottingham
Mrs. M. S. Prestwood
Mrs. Grace C. Schoeni
Mrs. Grace Phipps
Mrs. Jane Robison
Mrs. Rex Barlogi

### REGIONAL OFFICERS

Regional V-P, Victoria, B. C. .. Kenneth Reid
Chmn., British Columbia Section.. P. F. Fletcher
Chmn., Chinook Chapter ..... Martin Vickers
Chmn., Edmonton Chapter .... J. M. Connauton
Chmn., Inland Empire Chapter ..... E. E. Ralph
Chmn., Puget Sound Section ..... John C. Berg
Chmn., Vancouver Is. Chapter .. John Morrison
Chmn., Oregon Section ..... J. T. Cottingham

(News continued on page 24A)

# Inter-Mountain Regional Conference

*Photo: Electrical West.*

**NEW Mexico Chapter Chairman, Robert E. Detzler, and Dr. Albert Sutton, Pueblo optometrist, who spoke at session.**

**Date:** May 8-9, 1958
**Place:** Pueblo, Colo.
**Attendance:** 85

Cool, colorful Pueblo was the site of the Fifth Inter-Mountain Regional Conference, with conference headquarters at the new Downtown Motel. Technical sessions were held at the Pueblo College Vocational Auditorium, with the exception of one — a tour by bus to the United States Air Force Academy in Colorado Springs.

Other features on the program included a panel discussion on ballasts, the ever-popular "Most Interesting Lighting Job" contest, the President's Reception and Banquet, at which Mr. and Mrs. W. P. Lowell, of Sylvania, Salem, spoke on their impressions of "Life Behind the Iron Curtain," from their recent trip to Moscow. Complete program of technical talks is listed at the end of this report.

MMILJ Contest

Top honors in both divisions of the MMILJ contest went to the Rocky Mountain Section, with second and third prize going to the Arizona Section and Southern Colorado Chapter in each case. Winners were:

*Class I — Residential*

First — H. F. Rosenquist, Public Service Co. of Colorado, Denver.
Second — William Kellogg — Arizona Public Service Co., Phoenix.
Third — Carl F. Balsick — Pueblo Electric Supply Co., Pueblo.

*Class II — Commercial*

First — Norman Winchester, Independent Testing Laboratories, Boulder.
Second — A. G. Anderson, Arizona Public Service Co., Phoenix.
Third — Jack Bruno, Pueblo Electric Supply Co., Pueblo.

Tour of Air Force Academy

I.E.S. members making the tour of the new Academy were, on the whole, disappointed in the lighting as it is now installed. President K. M. Reid expressed the opinion that "The lighting will be obsolete by the standards that will prevail at the time the academy is completed." At the following day's technical session, however, Bernard A. Hemelt, chief of the electrical branch of the Academy construction agency, said that the lighting installation can be improved, since circuits, conduits and panels are loaded only 50 per cent.

Program

The conference was opened May 8 with a general session at which Lester A. Johnson, Chairman, Southern Colorado Chapter, presided. E. H. Pemberton, General Conference Chairman, introduced the guests and Fred H. Voss of the Pueblo City Council, welcomed the delegates. Regional V-P Gene Fleming responded. Four technical sessions followed:

**May 8 — Morning**

*Presiding* — F. C. Bates, Chairman, Utah Section.
Progress Report — J. H. McCulloch, Independent Testing Laboratories.
Plastics in Lighting — W. H. Kahler, Westinghouse Electric Corp., Cleveland.
Finance and Budget of I.E.S. — W. P. Lowell, Jr., Chairman, Finance Committee.

*(Continued on page 26A)*

*Photo: Electrical West.*

**MMILJ contest chairman Kenneth Stines, left, with session chairman Bob Godemann.**

**GIFT to the Reids from the Inter-Mountain Region was a handsome wooden bowl. President Reid expresses their thanks to Regional V-P Eugene Fleming, right.**

*Photo: Electrical West.*

**SPEAKER W. P. Lowell, Jr., left, with James Parker of Pueblo.**

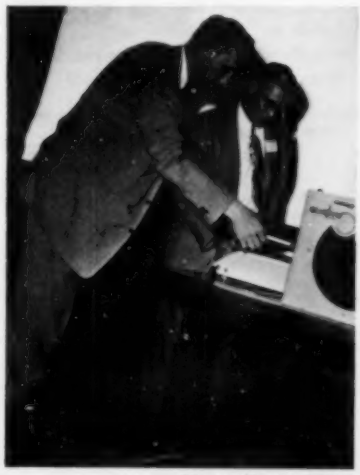


*Photo: Electrical West.*

**PANEL on ballasts was conducted by Gene C. Pauly and Joseph A. Setter.**

# problem solution

High-foot-candle levels from recessed fixtures were required for Pereira & Luckman's contemporary design of the new IBM Western Headquarters Building.

The ARGUS LUMINAIRE was designed by Lighting Dynamics. Now in production, it is the first recessed troffer using high output and very high output lamps supplying high-footcandle levels to critical seeing areas in drafting, engineering rooms, laboratories, banks, and offices. ARGUS' clean contemporary lines produce EXCITING ARCHITECTURAL EFFECTS with long parallel strips of unbroken light. This new series comes in a WIDE VARIETY OF WIDTHS AND LENGTHS that completely integrate with ceiling materials. Easy to install. As with all Lighting Dynamic luminaires, the Argus features durable, Bonderized and electrostatic, high-reflectance finishes. FOR MORE COMPLETE INFORMATION fill out the coupon below and mail to Lighting Dynamics, 802 West Whittier Boulevard, Whittier, California; or to Lighting Dynamics, 8700 Ambassador Row, Dallas, Texas.

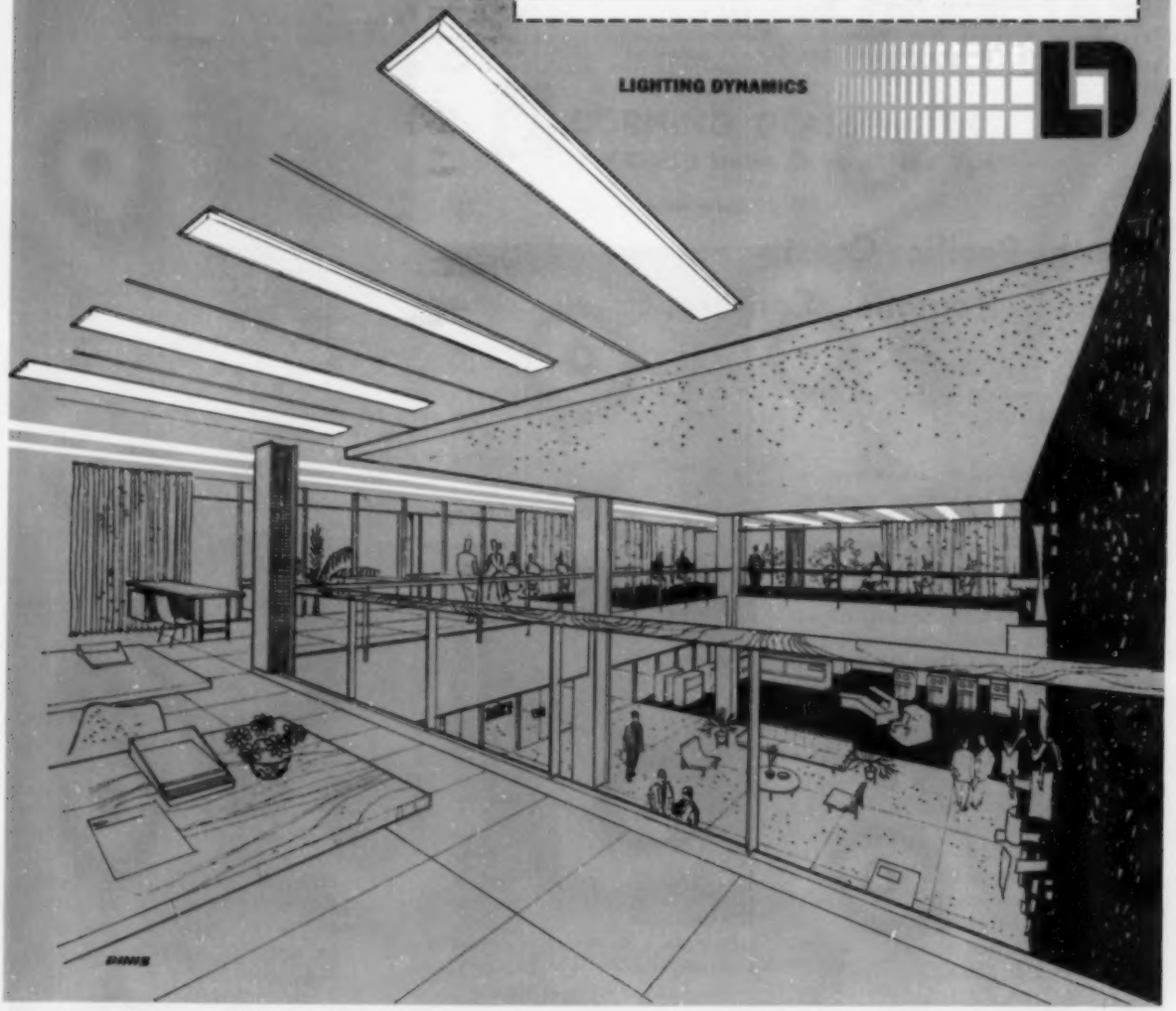
_____ *Send more information on* ARGUS.

_____ *Send your new catalog.*

NAME _____ PHONE _____

ADDRESS _____ TITLE _____

**LIGHTING DYNAMICS**



*ARGUS as it will be used in the IBM Western Headquarters Building designed by Pereira & Luckman.*

(*Continued from page 24A*)

Operation of High-Output Fluorescent Lamps — Willard C. Brown, General Electric Co., Cleveland.
Remarks on Air Force Academy — Lester A. Johnson, A.F.A. Construction Agency.
Lunch — at Pueblo Golf and Country Club.

### Afternoon

Bus tour to Air Force Academy site.

### May 9 — Morning

*Presiding* — R. W. Godemann, Secretary-Treasurer, Arizona Section.
My Most Interesting Lighting Job Contest — Kenneth Stines, Architect, Chairman.
Electrical and Lighting Systems Used at the Air Force Academy — A.F.A. Construction Agency Panel.
Lunch — at Minnequa Club.
Speaker — President Kirk M. Reid.

### Afternoon

Lighting Progress Demands Ballast Progress — Panel of E. C. Pauly, General Electric Co., Danville, Ill. and Joe A. Setter, General Electric Rocky Mountain District.
Phenomenal Footcandle Levels — C. L. Crouch, I.E.S. Technical Director.
Sight and Light — Dr. Albert A. Sutton, Optometrist, Pueblo.
President's Reception — at Minnequa Club, Leigh Congdon, Chairman.
Banquet — at Minnequa Club, Toastmaster, Gene Fleming. Speakers, Mr. and Mrs. W. P. Lowell.

**FIRST Prize winners, MMILJ — President Kirk Reid, at right in both photos, makes awards. In photo at left, Class I winner, Harold Rosenquist; in photo at right, Class II winner, Norman Winchester, with C. D. Bell at center. Both entries were from the Rocky Mountain Section of I.E.S.**

COMMITTEES

| | |
|---|---|
| General Conference | E. H. Pemberton |
| Executive | A. E. Fleming, J. D. Whitnell, Lester Johnson, William Stultz |
| Papers and Program | Carl F. Balsick |
| Registration and Reception | C. D. Bell |
| Finance | Robert F. Even |
| Publicity | Jack Bruno |
| Transportation | Ronnie Rowe |
| MMILJ Contest | K. J. Stines |
| Ladies | Joe Edwards, Mary Douglass |

# South Pacific Coast Regional Conference

**Date:** May 12-13, 1958
**Place:** El Cortez Hotel, San Diego, Calif.
**Attendance:** 195

Regional conference planners (any region) for next year's meeting, should request the loan of South Pacific's scrapbook. Their modus operandi should guide any conference to success.

Little extra touches are especially noticeable. The follow-up system, for example, of a series of letters starting as early as February 1st, sent to each and every member of the Region every few weeks. An official, signed invitation, a full month ahead, from the Mayor of Tijuana, Mexico (sent to each member) to be the city's guest at the Jai-Alai games. Conscientious organizers for each aspect of the conference is, of course, apparent throughout. For members who can't go to the conference, the importance of the meeting, the prestige of the Society and the announcement of local events has still been stressed. Those who can go reap the works.

Mayor Quiros' invitation was accepted rather promptly. Some 46 early arrivals left San Diego the Sunday evening prior to the Conference via chartered bus for Tijuana, armed with their official letter of welcome from Manuel Quiros L., Mayor of the City, and tickets for the races and Jai-Alai games. International regulations complied with, they continued into Mexico, to the El Prado Cafe. Here dinner arrangements awaited them — one long family table, with a choice of Mexican or steak dinner. President and Mrs. Reid were in this jolly party. As a remembrance, not that they could ever forget it anyway, the San Diego Section presented Mrs. Reid with a Mexican rabosa (white shawl), Mr. Reid with a Mexican sport shirt. After dinner the entire group attended the Jai-Alai games. Side wagers on favorite players spiced the excitement, but nobody broke the bank.

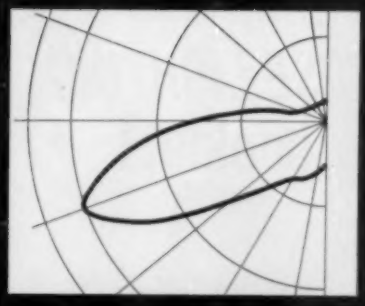
**FIRST prize in South Pacific Coast Region received, by Grant Florin, from President Reid.**

Official aspect of the conference opened Monday, May 12, with J. Walter Howard, Conference Chairman, presiding. The entire first session was devoted to the contest for "My Most Interesting Lighting Job" — a serious affair in this Region, which has bred national winners more than once. This year's entries, for which First will compete in Toronto:

*Class I — Residential*

First — Grant Florin, South California Section,
Second — Bob Haskell (Dave Parker Proxy), Golden Gate Section,
Third — Rex Gardiner, San Jose Chapter, and Alan McCutcheon, Jr., San Diego Section.

(*Continued on page 29A*)



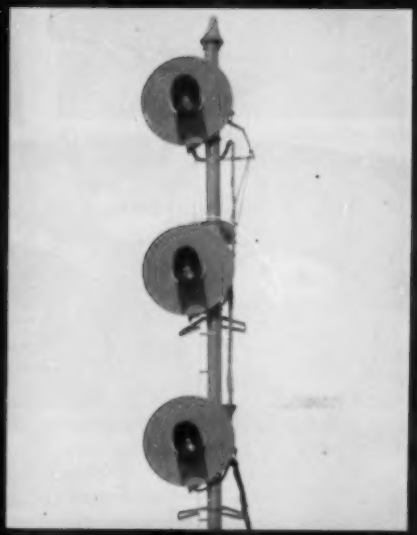
MAN has extended his pleasure, safety and comfort through control of light. Glass provides the medium necessary for such control. You will find both glass and knowledge to fit *your* lighting task at Corning.

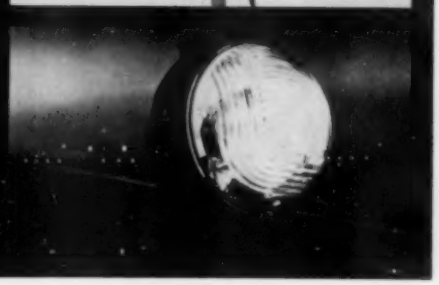
*Inquiries invited and welcomed.*

**CORNING GLASS WORKS**

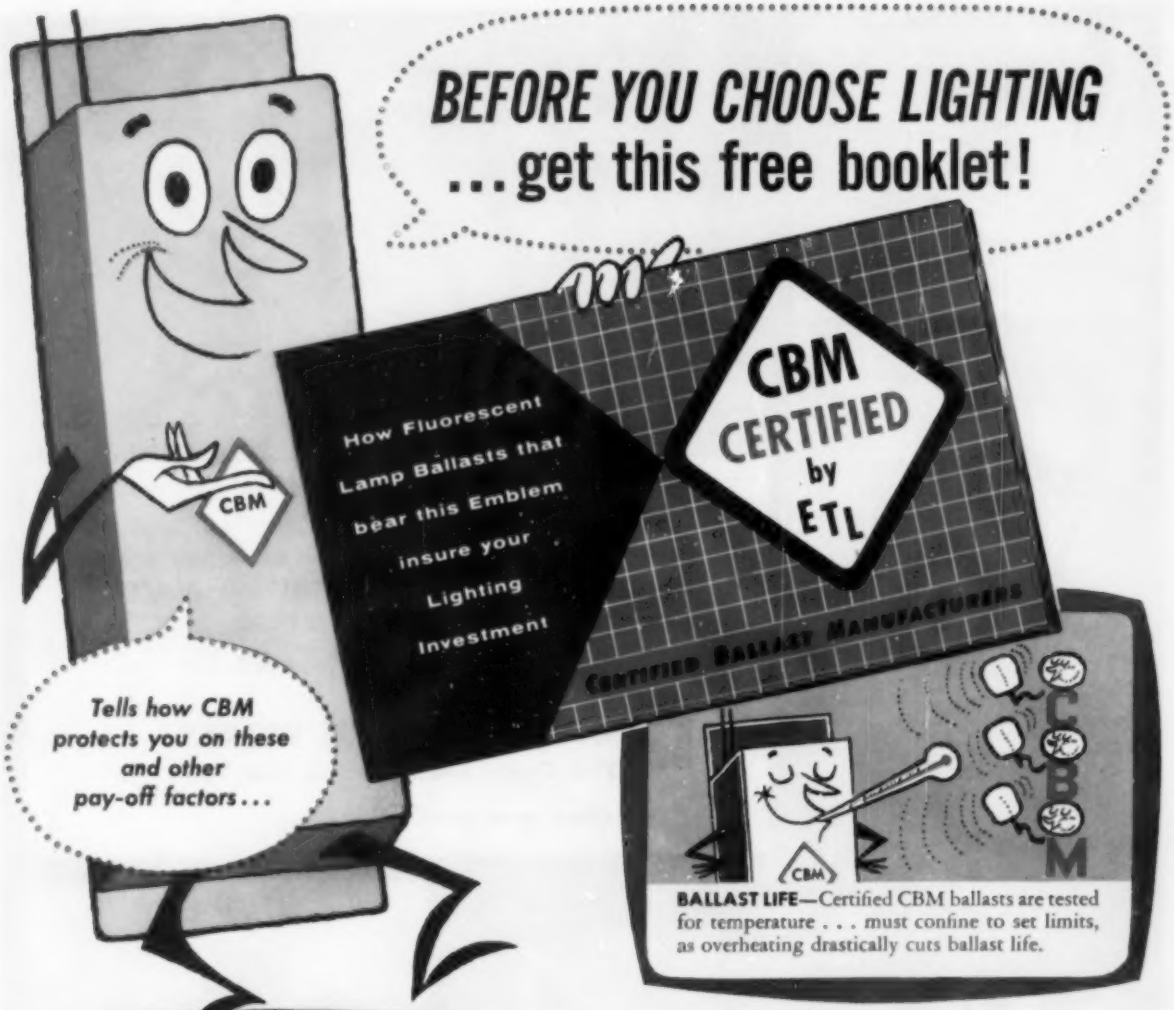
**33-8 Crystal Street, Corning, New York**

*Corning means research in Glass*

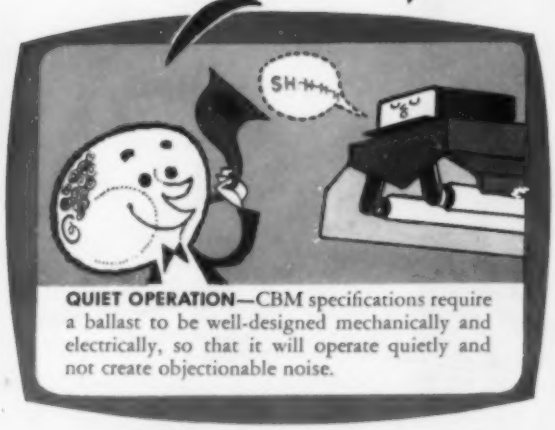




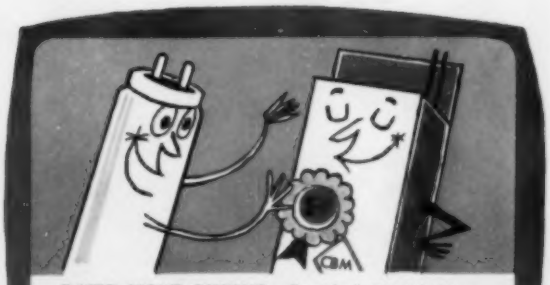
# BEFORE YOU CHOOSE LIGHTING ...get this free booklet!


CBM
How Fluorescent Lamp Ballasts that bear this Emblem insure your Lighting Investment
CBM CERTIFIED by ETL
CERTIFIED BALLAST MANUFACTURERS
Tells how CBM protects you on these and other pay-off factors...
CBM
CBM

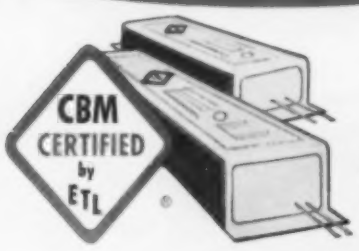
**BALLAST LIFE**—Certified CBM ballasts are tested for temperature . . . must confine to set limits, as overheating drastically cuts ballast life.




**QUIET OPERATION**—CBM specifications require a ballast to be well-designed mechanically and electrically, so that it will operate quietly and not create objectionable noise.




**RATED LIGHT OUTPUT**—Certified CBM ballasts are "tailored to the tube" . . . assure rated light output, steady light, peak lighting performance.




Send for this free booklet and learn how these factors and 11 others help insure your lighting investment when you buy fixtures equipped with Certified CBM ballasts.

## CERTIFIED BALLAST MANUFACTURERS

2116 KEITH BUILDING • CLEVELAND 15, OHIO

**Participation in CBM is open to any manufacturer who wishes to qualify**

CBM-6-D

**President Kirk Reid (second from right) is welcomed to San Diego by Vice-Mayor Frank E. Curran. Regional V-P C. M. Thompson (left) and Conference Chairman J. Walter Howard look on.**

**Section and Chapter Chairmen directing this successful South Pacific Coast Regional Conference are, left to right: G. E. Hersum, Mother Lode Chapter; C. W. Macy, Golden Gate Section; C. M. Thompson, Regional V-P; S. V. Monsees, San Diego Section, and Roy E. Bevan, Southern California Section.**

*(Continued from page 26A)*

*Class II — Commercial*

First — Jack Gates, Southern California Section,

Second — Team of Robert Schwartz and Ed Speer, Golden Gate Section,

Third — C. A. Dean, Jr. (Elton Harris Proxy), Mother Lode Chapter.

Another highlight of the opening day was a joint luncheon meeting with the Electric Club of San Diego. This was attended by San Diego's mayor Charles C. Dail, who gave an address of welcome. Featured speaker was I.E.S. President Kirk M. Reid. The afternoon's session presented two specialties: the Lighting Progress Report by J. H. McCulloch, and a preview of one of the Toronto conference papers, by J. S. Hamel, consulting engineer. This paper outlined the integration of lighting and air-conditioning in system calculations.

Tuesday's meeting started early—7:30 in the morning, with a Regional Activities Breakfast. Section and Chapter problems gave way at nine to the day's session, commencing with a discussion of extremely high output fluorescent lamps by Willard Brown, GE, Nela Park. Roy W. Matthews, California Division of Highways, followed him with an especially pertinent discussion of traffic safety lighting, which attracted some 42 non-registered extra delegates. Included in California's highway lighting experiments, he said, were fluorescent, mercury, and, for directional signs, black light and even electroluminescent letters.

At this session also, armed forces studies being conducted by Scripps Insti-

*(Continued on page 30A)*

**SPEAKERS at President's Luncheon: Conference Vice-Chairman Ralph W. Rohrbach, left, and William A. Cyr, Consulting Editor, *Electrical West*.**

**AND on the morning session, Dr. Seibert Q. Duntley, Director of the Visibility Laboratory, University of California (left) and C. L. Crouch.**

**MMILJ winners — Elton Harris, proxy for C. A. Dean, Jr.; Jack Gates; Ed Spear and his partner Robert Schwartz; R. J. Huff, Contest Chairman; J. Grant Florin, and R. L. Sawier, proxy for Red Gardiner.**

**MEANWHILE back at the ranch — the ladies conducted their own special program. Left, Mrs. Reid, wearing a Mexican rabosa, gift of the Ladies Committee; at center, a group of the girls gathered around the pool at the El Cortez Hotel; at right, a group of ladies arrives at the San Diego Zoo.**

**PERENNIAL "Teddy" Bear, Ed Spear, Willard Brown, Robert Schwartz, left to right. Photo by *Electrical West*.**

**HEAD table at the President's Banquet. Windows behind the table look out over the City of San Diego, the Pacific, and provide a sweeping view of the California and Mexican coastline.**

*(Continued from page 29A)*

tute of Oceanography on visibility through fluids of water and air were described by Dr. Seibert Q. Duntley. This vastly interesting presentation included the demonstration of instruments carried under water by divers and into the stratosphere by aircraft and balloons.

C. L. Crouch's succinct summary of the Blackwell researches and their impact on footcandle recommendations (see p. 416 this issue) completed the session.

Luncheon speaker was Bill Cyr, Consulting Editor for *Electrical West*. Mr. Cyr's proximity to and membership of South Pacific Coast Region is their program chairman's great good fortune. In the nature of an hilarious satire, Mr. Cyr's "Don't Make Light of Dark" was a wonderful delight.

Winding up the conference program was a talk which interested ladies as well as delegates. This was the discussion of "Life and Light Behind the Iron Curtain" by Mr. and Mrs. W. P. Lowell, Jr. Mr. Lowell is with Sylvania at Salem, Mass. Their fascinating talk, covering their recent trip to Moscow, is accompanied by a number of extraordinary colored slides.

### Socially

The South Pacific Coast conference attracted an unusually large number of ladies, so their social program was brilliant, to say the least. Top attraction was, of course, the President's Banquet, with entertainment and dancing. The setting, in the Cotillion Room of the fabulous El Cortez Hotel, heightened the feeling of attending a grand ball — a memorable event. President and Mrs. Reid were presented with gifts at this affair: a beautiful silver tray bearing the inscription "Mr. and Mrs. Kirk M.

*(Continued on page 32A)*

## *How to Handle GRID TYPE CEILINGS*
## *. . . and Handle Them Well . . . with* **LITECONTROL** *Lighting*

Pleasant place to make a deposit or withdrawal, don't you think? It's the People's National Bank & Trust Company, Levittown, Pennsylvania. Two of our newer type fixtures were used for illumination.

The public or main area utilizes Litecontrol No. 6142TS-66 fixtures on 8-foot spacing, in a grid type ceiling. Note the even quality of the lighting — only a suggestion of a shadow appears under the checkwriting desks. (Note, especially the long, right-hand desk, designed by the architect. It has no visible support except the lally columns.)

The adaptability or flexibility of this system is apparent. Note how the inverted aluminum T-bars run across the main ceiling down the side of the soffit over the Tellers' counters, and continue to the wall as an integral part of the *Luminous* Ceiling. This is a bank installation, but the concept makes a good, modern system for almost any interior.

The Luminous Ceiling over the Tellers' Area is illuminated by a corrugated vinyl plastic diffusing medium. If you have a similar installation, we may suggest or you may prefer Holophane #6024 acrylic low brightness lenses, corrugated Plexiglas, plastic grid louvers or Honeylite louvers. None of these are high cost "specials" . . . all can be used to obtain various correct lighting levels by different spacing of lighting strip fixtures, or by different switching of the fixtures. We have many fixtures especially designed for these ceilings — and for plaster and tile ceilings. Let us know your needs — for good lighting at sensible cost.

INSTALLATION:
The People's National Bank & Trust Co., Levittown, Pa.

AREA SHOWN:
Public Area and Tellers' Counters.

INTERIOR DESIGN:
Michael Melani, Architect, Levittown, Pa.

BUILDER:
John Brennen, Trevose, Pa.

MANUFACTURER OF BANKING FIXTURES:
John Brennan, Trevose, Pa.

FIXTURES:
Public Area, Litecontrol No. 6142TS-66 4 lamp 20 watt trigger start, recessed fixture with Corning #66 Alba-Lite glass.

Tellers' Area, Litecontrol Luminous Ceiling, with corrugated vinyl plastic; lighting strip, using 40 watt Rapid Start lamps, on 36" centers.

INTENSITIES:
Public Area, average 30 foot-candles in service. Tellers' Area, average 75 foot-candles in service.

LITECONTROL
*Fixtures*
KEEP UPKEEP DOWN
LITECONTROL CORPORATION.
36 Pleasant Street, Watertown 72, Massachusetts

DESIGNERS, ENGINEERS AND MANUFACTURERS OF FLUORESCENT LIGHTING EQUIPMENT DISTRIBUTED ONLY THROUGH ACCREDITED WHOLESALERS

**HAPPY memento of the memorable event — Regional V-P Thompson (left) presents sterling silver tray, suitably engraved, to President and Mrs. Reid. Occasion was the President's Luncheon in his honor.**

(*Continued from page 30A*)

Reid — in Appreciation. South Pacific Coast Regional Conference — San Diego, May 12-13, 1958."

One of a number of happy events on the ladies program was a visit to the famous San Diego Zoo located in Balboa Park with lunch at the Zoo Restaurant. They had their own bus for a guided tour of the entire area, stopping at many points of interest. They even toured the Children's Zoo, where child-sized animals may be petted, and where children may ride on the back of a giant turtle. Their program also included get-acquainted breakfasts each morning, during which Christmas-card lists grew by bounds.

FOR THE RECORD

### May 11

Bus Trip to Old Mexico. Dinner and Jai-Alai.

### May 12 — Morning Session

Opening Address — J. Walter Howard, Conference Chairman.
*Session Chairman* — Roy E. Bevan, Southern California Section.
Introduction of President, Illuminating Engineering Society, Kirk M. Reid.
My Most Interesting Lighting Job Contest — R. J. Huff, Officiating.
Luncheon joint meeting with Electric Club of San Diego — Cotillion Room.
*Chairman* — J. Walter Howard.
Welcome to San Diego — Mayor Charles C. Dail.
President's Address — Kirk M. Reid, President, Illuminating Engineering Society.

### Afternoon Session

*Chairman* — G. E. Hersam, Mother Lode Chapter.
Plastics in Lighting — W. H. Kahler, Westinghouse Electric Corp., Cleveland, Ohio.
Integrated Ceilings for Illumination — J. S. Hamel, Engineer, Burbank, Calif.
Lighting Progress Report — James H. McCulloch, Independent Testing Laboratories, Boulder, Colo.
President's Reception and no-host Cocktail Party — Cotillion Room.
President's Banquet, Entertainment and Dancing — Cotillion Room.

### May 13

Regional Activities Breakfast — Pool View Room.
Discussion of Section/Chapter, Regional, Business and Problems.

### Morning Session

*Chairman* — C. W. Macy, Golden Gate Section.
Extremely High Output Fluorescent Lamps — Willard C. Brown, General Electric Co., Cleveland, Ohio.
Traffic Safety Lighting — R. W. Matthews, Division of Highways, State of California.
Description and Function of Visibility Laboratory, University of California, Scripps Institution of Oceanography — Dr. Seibert Q. Duntley.
Phenomenal Footcandle Levels Developed by Dr. Blackwell's Researches — C. L. Crouch, Illuminating Engineering Society Technical Director.
Luncheon.
*Chairman* — Ralph W. Rohrbach.
*Speaker* — William A. Cyr, Consulting Editor, *Electrical West*, Don't Make Light of Dark.
Presentation of Awards.

### Afternoon Session

*Chairmen* — Marion G. Herbert, San Jose Chapter.
Light and Life Behind the Iron Curtain — Mr. and Mrs. W. P. Lowell, Jr., Sylvania Electric Products, Inc., Salem, Mass.
Lighting for Living Session — Jerre C. Blair, Moderator, General Electric Co., Lamp Division, Los Angeles, Calif.

COMMITTEES

| | |
|---|---|
| General Chairman | J. Walter Howard |
| Vice-Chairman | Ralph W. Rohrbach |
| Attendance | David F. Curtis |
| Audio-Visual Aids | Arthur C. Collins |
| Budget | James E. Reading |
| Entertainment | Mrs. Edward L. Peterson<br>Gordon S. Kimball |
| Finance | Willard J. Beran |
| Hotel | Charles Edwards |
| Ladies | Mrs. Edward L. Peterson<br>Mrs. Gordon S. Kimball |
| My Most Interesting Lighting Job Contest | Robert J. Huff |
| Papers and Programs | Carlton M. Thompson |
| Publicity | Alan J. McCutcheon, Jr. |
| Reception | Paul Conner |
| Registration | Carl Hotten |
| Sergeant at Arms | Gerald Atherton-Ely |
| Space Arrangements | Floyd W. Zwiener |
| Transportation | Harry E. Milse |
| Chairman, San Diego Section | S. V. Monsees |
| Regional Vice-President | Carlton M. Thompson |

## Progress Reported on United Engineering Center

In a speech before the Summer General Meeting of the American Institute of Electrical Engineers, Walter J. Barrett, AIEE president, reported "great progress" toward the construction of a United Engineering Center building to house the offices of engineering societies. The last twelve months, he said, "have seen the crystallization of plans, the acquisition of the site and the launching of fund raising drives." Site of the center is the entire block front on United Nations Plaza, between 47th and 48th Streets, New York City.

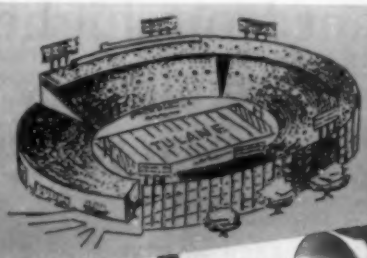
## Who Is I.E.S.? Membership Survey Reported

In order to learn more about the 8500 lighting practitioners who make up the Illuminating Engineering Society, lengthy questionnaires were sent, in the fall of 1957, to all United States and Canadian members. Most of the questions were detailed, requiring time and thought; but within the brief space of six weeks, 5360 loyal I.E.S. members in all grades had marked and returned their questionnaires for a better than 66 per cent response. From the analysis of these returns, the Officers and headquarters staff will gain

(*Continued on page 35A*)

## The Day the Gremlins Got In

Apologies are herewith tendered, to all concerned, for two errors in reporting which appeared in the June issue of I.E. Winner of the Class I division of the Southwestern Region's contest for My Most Interesting Lighting Job was Roger C. Gardner, Jr., of the Ark-La-Tex Chapter. And in the Midwestern Region's MMILJ contest, second place in Class II was awarded to the joint entry by Herbert Zepf, Lewis Sachs and Henry Poehling of the St. Louis Section.



# When Tulane goes "Light Conscious" the choice is...

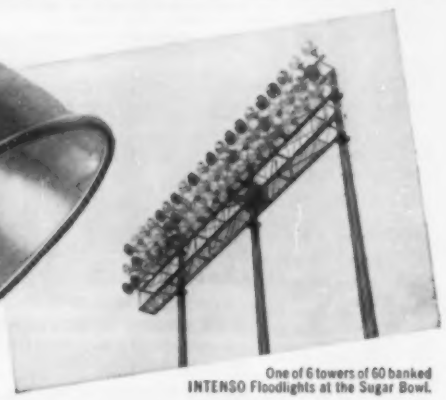
# APPLETON®

## INTENSO Trade Mark FLOODLIGHTS

Workmen at Sugar Bowl checking INTENSO light before bank is raised to lower height.

Photos courtesy of Tulane University

Opens for Split-Second Rear Relamping



One of 6 towers of 60 banked INTENSO Floodlights at the Sugar Bowl.

### Outstanding Features of APPLETON INTENSO FLOODLIGHTS

- Sights like a rifle to assure easy positioning . . . even in daytime
- Calibrated 360° horizontal and 100° vertical adjustment for hair-line positioning
- Easy to service . . . release 3 flip clamps and back of lamp swings up and locks in position for re-lamping
- No need to re-position floodlight after servicing
- Entire interior accessible from rear for easy cleaning
- Rear section repositioned automatically in sealing ring groove . . . equalized pressure against impregnated asbestos gasket protects against rain, ice, snow
- Exclusive louver ventilation provides lower operating temperature for longer lamp life
- Entire servicing job done without tools . . . in seconds

*"Always Daylight" Illumination Scores A Touchdown for Everyone at the New Orleans Sugar Bowl*

■ Unlighted for 30 years, the choice of lighting experts, maintenance and financial men at Tulane for illuminating the Sugar Bowl was APPLETON INTENSO Floodlights! Because only APPLETON-engineered INTENSO provides the accurately planned high intensity illumination, ease of servicing, cleaning, re-lamping, and positioning that gives maximum trouble-free, year-round lighting. Write for full information on the complete line of APPLETON Alzak Aluminum Floodlights!

*Sold Through Franchised Distributors Only*

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Explosion-Proof Fixtures

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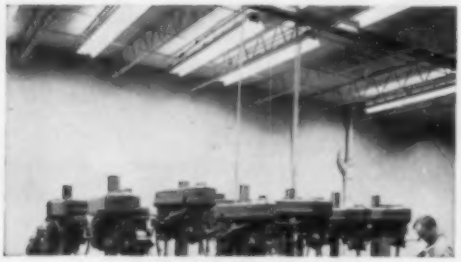
"Eagle Claw" Switch Boxes

# Whatever your customers want from higher output fluorescents...others are already getting...with G-E POWER GROOVES

**THESE SATISFIED POWER GROOVE USERS EACH WANTED SOMETHING DIFFERENT . . . AND ARE GETTING IT!**



SHAFER VALVE CO., MANSFIELD, OHIO

**WHY POWER GROOVES?** Because of improved color rendition and lower lamp replacement cost than mercury lamps.

JOHNSON-HILL'S DEPT. STORE, WISCONSIN RAPIDS, WIS.

**WHY POWER GROOVES?** To get more light (7½ times as much) from the same number of 40-watt lamps.

ERICKSON TOOL CO., CLEVELAND, OHIO

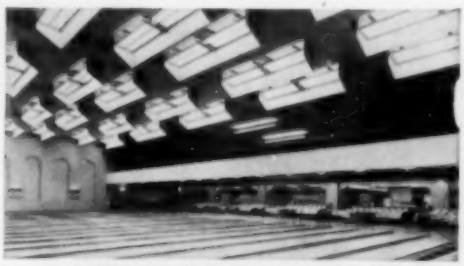
**WHY POWER GROOVES?** To get higher, more economical production lighting levels (160 footcandles), with no need for supplemental lighting.

GENERAL IRON & METAL CORP., CHICAGO, ILL.

**WHY POWER GROOVES?** To increase worker efficiency, speed-up production, reduce customer complaints.

CONVAIR, SAN DIEGO, CALIF.

**WHY POWER GROOVES?** To get the lowest operating cost compared to filament and mercury, and the highest level of light per watt.



PLA-MOR BOWLING ALLEYS, KANSAS CITY, MO.

**WHY POWER GROOVES?** To provide Pla-Mor lanes with a revolutionary, glare-free lighting system—superior to that in any other bowling center.

Don't *experiment* with your customers' lighting. Give them the newest fluorescent lighting that is endorsed by enthusiastic users all over the country. That *one*, of course, is the *tried-and-proved* General Electric Power Groove Lamp. Think of it! Almost twice the light of High Outputs—more than 2½ times the light output of slimlines! Power Groove users save up to 20% on initial cost, and keep maintenance at rock bottom at the same time. Call your local General Electric Large Lamp salesman right now and let him explain the whole Power Groove story to you. Or write: General Electric Co., Large Lamp Dept. C-839, Nela Park, Cleveland 12, Ohio.

*Progress Is Our Most Important Product*

GENERAL ELECTRIC

(Continued from page 32A)

better understanding of the business interests of the membership, to plan extensions of present and future services of the Society to its members more knowledgeably, and obtain a better idea of the importance of the official publication, ILLUMINATING ENGINEERING, to each member. As a matter of interest, every reply is now recorded on a punched card for analysis.

To make the survey analysis completely objective, all questionnaires were returned by members directly to John T. Fosdick Associates, nationally known research analysts, for tabulation and analysis. No member of the headquarters staff or Officer of the Society saw the returns prior to their tabulation or influenced the analysis in any way. The final report of the Fosdick survey comprises eight pages of practically solid columnar percentages. A few of these tables, of general interest, are presented here.

Two points with regard to the survey might be stressed. First, a 66 per cent reply to a lengthy and detailed questionnaire in a period of six weeks is phenomenal and indicates the interest and cooperation that I.E.S. members offer the group. Secondly, the present active individual membership of all grades is about 8500 and all percentages in the tables should be interpreted in relation to that number. To quote Mr. Fosdick: "Based upon this agreement between these two groups of returns [returns from first and second mailings were tabulated separately and compared] and upon the total return of over 66 per cent, we believe that the figures reported in the following pages are reliable and representative of all membership."

Where do I.E.S. members work? Table 1 of the Fosdick survey shows the replies to the question, "What is the principal business of your company or division?" Respondents were asked for the "principal" business, but were further requested to check the *most* important if they checked more than one.

In what fields of lighting do I.E.S. members specialize? This inquiry was covered by the question, "If your present work is directed primarily to one or two special fields of lighting, please check these on list below." Table 2 shows these special interests. A cross-analysis of the preceding information is given in Table 3.

Tables 6 and 7 of the Fosdick report pertain to characteristics of the members

(Continued on page 36A)

## SCHEDULED EVENTS

**August 17-22, 1958** — Illuminating Engineering Society (National Technical Conference), Royal York Hotel, Toronto, Canada.

**August 19-22, 1958** — American Institute of Electrical Engineers, Pacific General Meeting, Sacramento, Calif.

**September 12-13, 1958** — Plastics for the Automotive Industry, St. Clair River Inn and Country Club, St. Clair, Mich.

**September 22-25, 1958** — Institute of Traffic Engineers (Annual Meeting), McAllister & Columbus Hotels, Miami, Florida.

**October 8-10, 1958** — Canadian Electrical Manufacturers Association (14th Annual Meeting), Sheraton Brock Hotel, Niagara Falls, Canada.

**October 10-11, 1958** — International Association of Electrical Inspectors (Canadian Section), Toronto, Ont.

**October 13-14, 1958** — U. S. National Committee of the International Commission on Illumination (C.I.E.), Annual Meeting, Nittany Lion Inn, State College, Pa.

**October 13-15, 1958** — National Electronics Conference, Inc., Hotel Sherman, Chicago, Ill.

**October 19-24, 1958** — Society of Motion Picture and Television Engineers, Sheraton-Cadillac Hotel, Detroit, Mich.

**October 20-24, 1958** — National Safety Council (46th National Safety Congress & Exposition), Chicago, Ill.

**October 27-31, 1958** — American Institute of Electrical Engineers (Fall General Meeting), Pittsburgh, Pa.

**November 10-14, 1958** — National Electrical Manufacturers Association (Annual Meeting), Traymore Hotel, Atlantic City, N. J.

**November 16-20, 1958** — American Standards Association (9th Annual Conference on Standards), Hotel Roosevelt, New York, N. Y.

**January 19-23, 1959** — American Institute of Electrical Engineers (Winter General Meeting), New York, N. Y.

**February 8-14, 1959** — National Electrical Week.

**March 1-4, 1959** — Second National Lighting Exposition, New York Coliseum, New York, N. Y.

**March 1-4, 1959** — National Electric Sign Association, Morrison Hotel, Chicago, Ill.

**March 30 - April 1, 1959** — Chicago Electrical Industry Show, Hotel Sherman, Chicago, Ill.

**May 3-8, 1959** — Society of Motion Picture and Television Engineers, The Fontainbleau, Miami Beach, Fla.

**May 24-29, 1959** — National Association of Electrical Distributors (51st Annual Convention), Conrad Hilton Hotel, Chicago, Ill.

**June 22-26, 1959** — American Institute of Electrical Engineers, Summer and Pacific General Meeting, Seattle, Wash.

**Table 1 — Principal Business of I.E.S. Members.**

| Type of Business | Number | Per Cent |
|---|---|---|
| Architect | 192 | 4% |
| Consulting engineer | 605 | 11% |
| Government engineer | 103 | 2% |
| Industrial engineer | 99 | 2% |
| Electrical utility | 1,152 | 21% |
| Electrical wholesaler or distributor | 558 | 10% |
| Electrical contractor (not included above) | 330 | 6% |
| Teacher, instructor, professor | 349 | 6% |
| TOTAL NON-MANUFACTURING | 3,388 | 62% |
| Manufacturers, lamps | 539 | 10% |
| Manufacturers, fixtures | 848 | 16% |
| Manufacturers, other | 585 | 12% |
| TOTAL MANUFACTURING | 1,972 | 38% |

**Table 2 — Special Fields of Lighting of Interest to Members.**

| Field of Specialization | Number | Per Cent |
|---|---|---|
| Industrial | 2,474 | 46% |
| Commercial | 2,866 | 53% |
| Public buildings and institutions | 1,884 | 35% |
| Residential | 920 | 17% |
| Street and highway | 944 | 18% |
| Outdoor and flood | 1,302 | 24% |
| Do not specialize or concentrate on selected field | 1,181 | 22% |
| Specialize, but in other fields not listed | 456 | 9% |

**Table 3 — Field of Specialization vs Principal Type of Business.**

| Type of Business | Industrial | Commercial | Public Building | Residence | Street & Highway | Outdoor & Flood |
|---|---|---|---|---|---|---|
| Total | 46% | 53% | 35% | 17% | 18% | 24% |
| Architect | 45% | 60% | 58% | 17% | 9% | 15% |
| Consulting engineer | 53% | 60% | 53% | 12% | 16% | 25% |
| Government engineer | 15% | 6% | 40% | 3% | 37% | 17% |
| Industrial engineer | 56% | 42% | 30% | 12% | 10% | 29% |
| Electric utility | 37% | 54% | 29% | 19% | 25% | 30% |
| Electrical wholesaler or distributor | 53% | 57% | 26% | 33% | 13% | 26% |
| Electrical contractor | 63% | 71% | 33% | 22% | 6% | 21% |
| Teacher-instructor | 32% | 40% | 32% | 14% | 12% | 18% |
| Lamp manufacturer | 34% | 32% | 16% | 17% | 13% | 14% |
| Fixture manufacturer | 62% | 71% | 50% | 13% | 16% | 24% |
| Other manufacturer | 42% | 42% | 28% | 13% | 27% | 29% |

(Continued from page 35A)

themselves. Answers to the question, "What is your title or position?" are grouped into nine major classifications. It is apparent that, in addition to architects whose principal business is architecture, there are architects working for other businesses, even manufacturers. Similarly, not all members who reported their principal business as "architecture" are "architects" by title.

Also of importance are the principal functions or duties of I.E.S. members, tabulated in reply to "Please check your principal functions or duties." A check list of five functions was supplied with space for additional entries. Many respondents named several functions and ranked them in order. Table 7 shows only those ranked as most important, reported according to the type of business.

**Table 6 — Titles of I.E.S. Members vs Their Principal Business.**

| Title or position | Total | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| President, vice-president, officers & directors | 16% | 17% | 30% | 3% | 17% | 3% | 21% | 54% | 19% | 11% |
| General managers, managers, plant or production managers, superintendents | 13% | 4% | 4% | 12% | 32% | 14% | 23% | 11% | 10% | 15% |
| "Lighting specialist" | 4% | — | 1% | 4% | — | 8% | 9% | 1% | 2% | 3% |
| Illuminating engineer | 3% | 2% | 2% | 4% | — | 7% | 2% | * | 1% | 3% |
| Electrical engineer | 7% | 35% | 28% | 44% | 18% | 2% | — | 6% | 5% | 2% |
| All other engineers | 12% | 14% | 17% | 18% | 18% | 9% | 1% | 6% | 7% | 15% |
| Sales and advertising managers | 8% | 1% | * | — | 1% | 13% | 11% | 3% | 2% | 11% |
| Salesmen, sales engineers | 22% | 2% | 1% | — | 2% | 29% | 25% | 3% | 14% | 31% |
| Miscellaneous employees of firms | 6% | 5% | 4% | 9% | 8% | 5% | 4% | 11% | 9% | 5% |
| Independent consultants | 2% | — | 5% | — | 2% | 7% | 1% | * | 3% | 1% |
| Architects-draftsmen | 1% | 16% | 1% | 1% | — | 1% | — | * | 1% | * |
| Teachers, physicians, optometrists and ophthalmologists | 2% | 2% | 3% | 3% | 1% | — | — | — | 17% | * |
| No answer | 4% | 2% | 4% | 2% | 1% | 3% | 3% | 5% | 10% | 3% |

*Less than 1%.

**Principal Business**

1. Architectural firms
2. Consulting engineering firms
3. Government engineers
4. Industrial engineers
5. Electric utility
6. Electrical wholesaler-distributor
7. Electrical contractor
8. Teacher, instructor
9. Manufacturer — lamps, fixtures, parts.

**Table 7 — Functions or Duties.**

| Principal Business | Principal Function of I.E.S. Members 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| Total | 35% | 7% | 2% | 25% | 2% | 11% | 18% |
| Architectural firm | 3% | 1% | 1% | 68% | — | 10% | 17% |
| Consulting engineer | 3% | 1% | 1% | 76% | 1% | 7% | 11% |
| Government engineer | — | 2% | 4% | 55% | 2% | 24% | 13% |
| Industrial engineer | 11% | — | 25% | 35% | — | 7% | 22% |
| Electric utility | 25% | 23% | 1% | 30% | * | 6% | 15% |
| Electrical wholesaler-distributor | 67% | 2% | 1% | 4% | * | 4% | 22% |
| Electrical contractor | 26% | 2% | 9% | 18% | — | 15% | 30% |
| Teacher-instructor | 26% | 4% | 3% | 15% | — | 23% | 29% |
| Manufacturer, lamps | 57% | 4% | 1% | 6% | 1% | 16% | 13% |
| Manufacturer, fixtures | 54% | 4% | 1% | 6% | 10% | 3% | 20% |
| Manufacturer, other | 40% | 5% | 2% | 14% | 3% | 17% | 19% |

*Less than 1%.

**Principal Functions**

1. Sales
2. Sales promotion or advertising
3. Service or maintenance
4. Engineering design and layout of lighting systems
5. Engineering and design of fixtures
6. All other duties
7. No answer

## Mrs. L. B. Marks Awarded I.E.S. Past-President's Pin

In recognition of her late husband's historic service to illuminating engineering as Founder and first President of I.E.S., the Society's Past President's Pin has been awarded to Mrs. L. B. Marks. The presentation took place June 26, at a luncheon in her honor, held at the Engineers Club, New York City. Accompanying the Pin was an embossed Certificate on which was inscribed:

CERTIFICATE OF AWARD
PAST-PRESIDENT'S BADGE
This Scroll, accompanied by Past President's Badge is awarded to
MRS. LOUIS BENEDICT MARKS

(Continued on page 39A)

**PAST-PRESIDENT'S PIN and Certificate of Appreciation is awarded to Mrs. L. B. Marks to honor her late husband, IES' first President (1906). In picture at left her son George Marks affixes the diamond-studded pin. At right,**

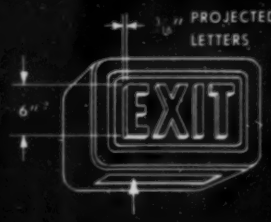
**Past-Presidents attending luncheon in her honor: l. to r. W. F. Little, M. N. Waterman, Mrs. Marks, George Marks, S. G. Hibben. The luncheon was held at the Engineers Club in New York City.**

# POINT THE WAY

## with NEW, PROJECTED LETTER

## FLUORESCENT EXIT UNITS by PERFECLITE

SURFACE-TYPE UNIT




Check These Superior Features:

Phosphorescent Lucite panel gives ½ hour after-glow should the circuit become dead. 6" projected letters. Available in models for all surface type as well as recessed installations. Mounted from top, back, side or from a pendant. Surface models are also available for either single or double face use. Pivot hinged, die formed 20 ga. steel frames for easy servicing. Surface type boxes are made of 18 ga. press drawn steel, ½" KO's top and side. Recessed boxes are of 20 ga. press drawn steel, six ½" KO's.

Lucite faces available in 4 color combinations — with or without arrows. Completely wired for two T-5 6-watt lamps, 118-V. AC ballasts. Also available for use in 277-V. systems.

*You reduce installation costs, make every building safer when you select Perfeclite unbreakable projected letter fluorescent exit signs. For further information, mail the attached coupon today!*

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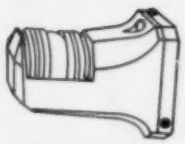
# Revere Outdoor Lighting Report

## Lighting a building exterior

**The Problem:** To highlight a new building through the use of dramatic lighting of the building exterior. Fixtures must be attached to the building itself.

**The Answer:** Ten Revere No. 3151 Underneath Floodlights were installed to provide a source of uniform, glare-free light for the exterior walls of the building. Underneath Floodlights were chosen because they are unobtrusive and because they project a wide, flat pattern of light. Fixtures are completely weather-tight and insect-proof.

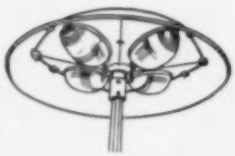


No. 3151 Underneath Floodlight

## Lighting a shopping center parking lot

**The Problem:** To illuminate the large parking lot of a modern shopping center, providing a safe, attractive place for shoppers to leave their automobiles.

**The Answer:** Revere Ultra-Lites, multiple mercury luminaires, were installed throughout the parking area. The square light patterns were overlapped to achieve a uniform, glare-free light level. The use of Ultra-Lites cut pole requirements by more than 50% because of much higher utilization of light per fixture.



No. 5442 Ultra-Lite

## Lighting a residential street

**The Problem:** To light a quiet neighborhood street with moderate-level illumination concentrated on the street with lesser amount on the sidewalk.

**The Answer:** Revere Urban-Lite luminaires were installed on one side of the street. Projection pattern of units made possible the even lighting of street and additional light on sidewalk with minimum stray light entering adjacent homes. Urban-Lite is an economical way to utilize smaller, highly efficient mercury lamps.

No. 2100 Series Urban-Lite

*Write for Revere's complete catalog of outdoor lighting equipment*

Revere ELECTRIC MFG. CO.

**OUTDOOR LIGHTING**

**Revere Electric Mfg. Co. • 7420 Lehigh Avenue • Chicago 31, Illinois**

*Available in Canada thru Curtis Lighting, Ltd., Leaside, Toronto, Ontario*

(Continued from page 36A)

In honoring the memory and commemorating the undying achievements of her late husband, Mr. Louis B. Marks, I.E.S. First President, 1906-1907

Three Past Presidents of the Society, two of them very old friends of Mrs. Marks, attended the luncheon. Present were, S. G. Hibben, who as Chairman of the Historical Committee made the presentations, W. F. Little, M. N. Waterman, Mr. George Marks, her son, and Ruby Redford, Editor of I.E. Delightful reminiscences of IES Conventions all the way back to 1907 were a main topic of conversation, particularly with Messrs. Little and Hibben, long-standing friends of both Mr. and Mrs. Marks.

## Plastics Engineering Degree Conferred by Lowell Institute

The degree of Bachelor of Science in Plastics Engineering was granted to eight graduates of Lowell Institute of Technology, Lowell, Mass., this past June, marking the first time, according to the Society of Plastics Engineers, such a degree has been conferred.

To recognize this event and to honor the recipients, three national officers of SPE participated in a special meeting of the graduates and faculty members at Lowell. National president R. K. Gossett, director Ralph L. Mondano and executive secretary Thomas A. Bissell addressed the group on the plastics industry, its present and future.

# ABOUT PEOPLE

Several new appointments have been announced by the Westinghouse Electric Corp., Lamp Division, Bloomfield, N. J. **Joseph F. Kempf, Jr.** has been named general sales manager of the Division and will direct the sale of all lamp products. **Hugh J. Hanbury,** most recently sales manager of the photo lamp department is now marketing manager of the new photo-miniature lamp department. In the regional sales phase of the company's operations, **David H. Nelson** has been appointed sales manager for the

(Continued on page 45A)

## leaves from the... HISTORICAL COMMITTEE'S SCRAPBOOK

### MMILJ Contest in 18th Century France

Did you ever hear the story of the first winner of a "My Most Interesting Lighting Job" contest? The tale, of how a famous man won the King's medal for the best lighting design, might be more famous had there been an MMILJ award in the eighteenth century. In its blend of humor and sadness, of human mistakes and achievements, the tale is worth telling, the history is worth remembering.

Back of La Madeleine, on the boulevards of Paris, there stood (until the Nazis melted it into bullets) the statue of a young man, dead now these one hundred sixty-four years, whose sensitive eyes looked far away, over the old ladies of the flower kiosks or the heads of heedless tourists, seemingly staring at visions of remote scientific miracles. And well he might, for Antoine Laurent Lavoisier (1743-1794) was among the world's great experimental research engineers, a renowned physicist and by far the greatest chemist of his time.

**But among his many scientific studies is one of rare significance — contending for the prize of 2000 livres (roughly $400, had there been dollars) offered by the Academy of Sciences for a design of the best street lighting system and equipment for the City of Paris.**

The city, ancient even in 1765, bore little resemblance to Paris of today. Her streets, like those of all cities, were dangerously dim. "At night the lack of adequate illumination made them the successful haunts of those on evil bent, and the hire of a torch bearer did not always assure immunity from attack!" But Paris, "City of Light," was leading all others, and had indeed for a century.

In 1524, the Parliament had ordered every citizen to place a lantern at his window. By decree, in 1558, a lantern was to burn at each street corner. In 1667, Louis XIV's lieutenant ordered lanterns placed at every square and crossroads, with a medal carrying the motto, "Urbis securitas et nitor." But there was need for doing even better.

So the Academy of Sciences offered a prize for the "best method of lighting the streets of a large town at night, combining brightness, ease of use, and true economy." Lavoisier, then only 23 years old, entered the competition. He knew of the eyes' brightness adaptation, and in order to study the systems then in use, for six weeks he kept to a dark room in daylight and made his outdoor studies only at night.

Months were devoted to the survey. Lavoisier measured and compared the efficiencies of candles, and of oil lamps, shapes of reflectors, suspensions and methods of maintenance. Long before his Swiss colleague, M. Argand (1782), Lavoisier studied shapes of wicks and air drafts. Twenty-three years before the birth of M. Fresnel, he suggested a type of ribbed or prism glazing to spread the light. Eighty-two years before Edison's birth, Lavoisier wished for a light source steadier than the flickering flame, but for a source all he could devise was mounting the oil reservoir on gimbals so that the oil remained level as the lantern swayed in the wind.

But his winning "MMILJ" design of a street lighting lantern was a masterpiece. It had the functional simplicity of the New England Colonial lantern; odd, in contrast to the ornate or curling leaves, fins or scrolls of the lamps at Versailles or those of a Stanislas Place at Nancy.

The bug-tight sloping prismatic side panels and the suggestion of downward or asymmetric distributions anticipate today's best street lighting principles. Perhaps young Antoine Laurent talked of his designs with his friends, Du Pont (whose name later gained fame in America) or Bailly (later mayor of Paris). In any case, an unprecedented award of the King's special gold medal was made to Lavoisier by the President of the Academy on 20th August (9th April?), 1766.

We may only speculate how much this lighting study could have influenced street lighting for generations, or how Lavoisier's influence in scientific pioneering might have affected the highways of the world had he not been guillotined for being an honest, ingenious, brave public servant who tried to brighten the paths of mankind.

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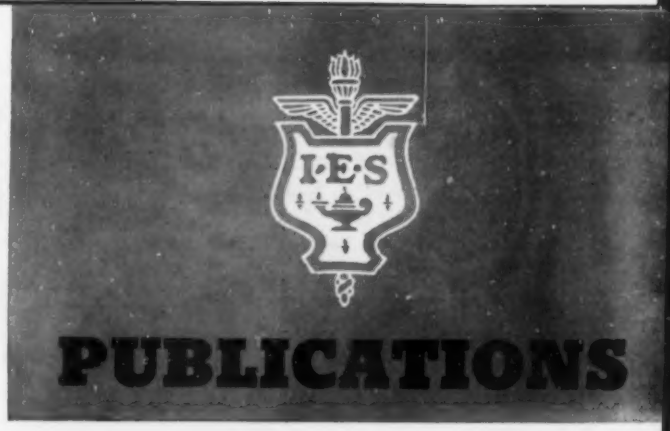


The Publications of the Illuminating Engineering Society listed here summarize the vast amount of research, investigation and discussion of hundreds of qualified members of the Society working on technical committees. Each publication listed here is supported by the full authority and approval of the Illuminating Engineering Society.

I.E.S. Publications are available, in single copies or in bulk, to anyone requiring knowledge of the newest in lighting application and the supporting technical information. Should quantities be desired for distribution, such as for educational or promotional purposes, prices may be obtained by writing Publications Office.

Each publication is numbered for easy ordering by using the coupon on this page. Correspondence concerning publications should be addressed to: Publications Office, Illuminating Engineering Society, 1860 Broadway, New York 23, N. Y.

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These booklets are the complete, standard recommendations for lighting the prescribed areas, and are among the most comprehensive and important of all Society publications. As indicated, some of these recommendations are the work of committees of the American Standards Association, with collaboration by appropriate committees of the I.E.S. All have the approval of the Council of the Illuminating Engineering Society, and are the latest official I.E.S. recommendations.

In general, the information contained in these Recommended Lighting Practices covers completely the area shown in the title. Included in the data are suggested types of lighting systems and luminaires; levels for general lighting and for specific areas; analyses of seeing tasks; and other information essential to lighting the area and of value to lighting engineers and specialists, architects, construction people and others. Each practice is fully illustrated with charts and photographs.

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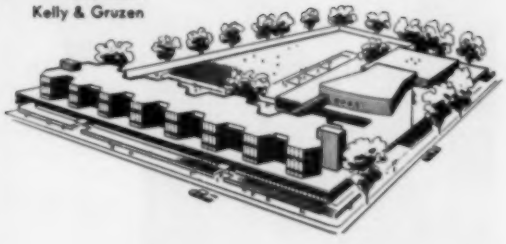

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(Continued from page 39A)

southwest; **Robert D. Barr** will be in charge of midwestern sales. Also announced by Westinghouse is the retirement of **William B. Gero** after more than 41 years of service with the Lamp Division. Mr. Gero, who joined the firm as an engineer, was assistant to the general manager at the time of his retirement. He is also Mayor of Milburn Township, N. J.

**Martin A. Warskow** has been appointed consultant to the Department of Aviation Systems Research, Airborne Instruments Laboratory, Mineola, N. Y. in the fields of airports, landing aids (including lighting), heliports and air traffic control. Prior to this association, Mr. Warskow was supervisor of Airport Navigation Standards for the Port of New York Authority. He will continue his active association with the Aviation Lighting Committee of I.E.S.

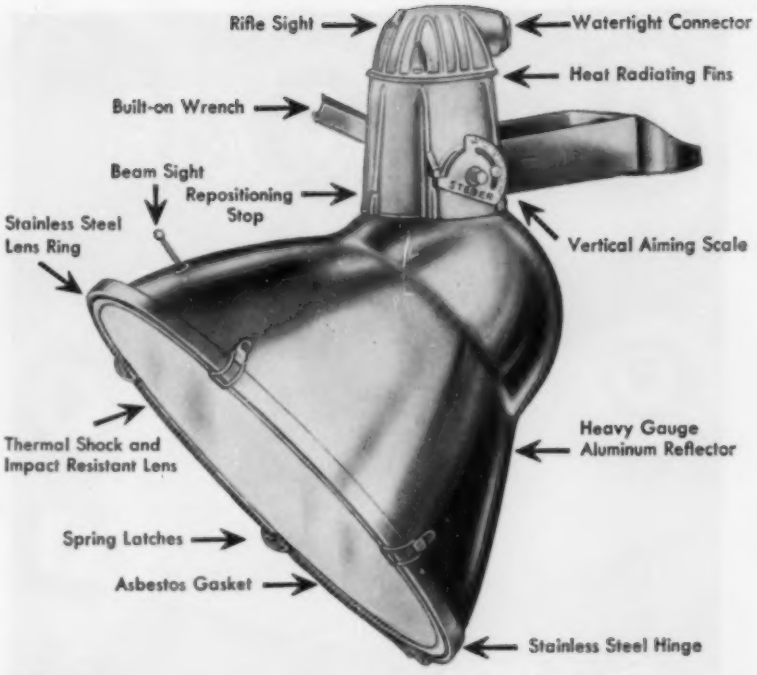
Corning Glass Works has announced the formation of a new department, Industrial Components, with the following personnel: **R. Dale Sweigart,** manager; **Lawrence E. Kelley,** field sales manager; **W. F. Crosby,** supervisor of lighting products development and **John P. Hoxie,** product specialist for outdoor and signal lighting products. In other divisions of the company, **Daniel L. Killigrew** has been named assistant to the general sales manager of the Technical Products Division and **John E. Lillich** has been promoted to supervisor of lamp products engineering, Lamp Sales Department.

Union Metal Manufacturing Co., Canton, Ohio has opened a northwest district sales office in Portland, Ore. with **G. W. Kolling** as manager. Also announced is the transfer of **E. B. Moss** from the company's headquarters to the southeast district with offices in Decatur, Ga.

Sylvania Lighting Products Inc. has named **Carl E. Nelson** as special products sales engineer for the midwestern region and **Louis P. Robinson** as sales supervisor for the Atlanta district. The signing of **Raph J. Bogan, Jr.** and Co., Chicago, as exclusive sales agent in metropolitan Chicago for fluorescent fixtures and lighting systems has also been announced by the company.

**Kenneth L. Odehnal** has been named manager of the commercial lighting department of Englewood Electrical Supply Co., Chicago, succeeding **Jack Anderson** who resigned to become sales manager for Lighting Maintenance Co., Albu-

(Continued on page 46A)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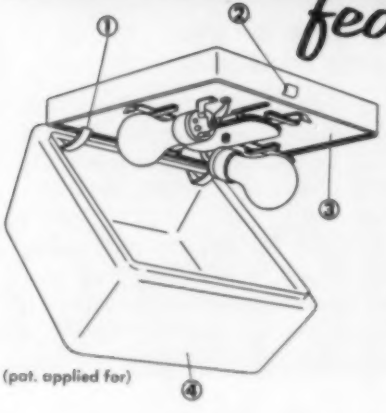


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*(Continued from page 45A)*

querque, N. M. Mr. Odehnal was most recently a salesman in the firm's apparatus and supply division.

Ebasco Services Inc., N. Y., has appointed **Marvin F. Hall** consulting gas engineer with full charge of all gas engineering activities.

**D. Jack Clark** has been appointed lighting sales engineer for Georgia and parts of South Carolina by the Edwin F. Guth Co., St. Louis. Prior to this appointment, Mr. Clark was a sales engineer with the McKinney-Newman Co., Electrical Distributors, for 12 years.

**J. L. Singleton,** vice-president, Industries Group, Allis-Chalmers Manufacturing Co., Milwaukee, Wis. was elected president of NEMA to fill the unexpired term of the late **W. V. O'Brien.** Mr. Singleton, a member of the Association's Board since 1952, has served as a vice-president of the organization since 1955.

The election of **L. F. Hickernell** as 1958-1959 president of AIEE was announced at the organization's Summer General Meeting at the Statler Hilton Hotel, Buffalo, N. Y. Mr. Hickernell is vice-president—engineering with the Anaconda Wire and Cable Co., Hastings-on-Hudson, N. Y.

**Ed Schnoll,** former lighting engineer for Standard Electric Supply Co., Milwaukee is now a sales representative for lighting equipment manufacturers. His offices are at 7632 North Van Dyke Road, Milwaukee.

**Dale Gunther** and **Ronald R. Overs** have been signed as sales representatives by the John C. Virden Co., Cleveland. Mr. Gunther, who will cover eastern Pennsylvania, central and southern New Jersey, Delaware and Maryland, will make his headquarters in Philadelphia. He succeeds **Vern Wrye** who has been promoted to new responsibilities in the firm. Mr. Overs will cover the northwestern New York and Erie, Pa. territory under the direction of William Newell, district manager. **Clyde E. Dodd,** formerly Electric Dept. buyer for Marshall-Wells Co., Portland, Ore., recently became associated with Virden's northwest sales representative, Donald Gleason.

**J. Stewart Stein,** Chicago architect, was recently elected president of the Construction Specifications Institute, an organization of architects, engineers, specification writers and others connected with the building industry.

# BOOKS AND PAMPHLETS

**Flickering Flames** — A History of Domestic Lighting, published by the Charles H. Tuttle Co., available from Fred Burdett, President of the Rushlight Club, 160 Beacon St., Boston, Mass. 97 plates, 8 figures, 42 sketches. Price: $5.00.

Illuminating engineers who speculate about the beginnings of the lighting industry will probably be interested in this book by the Rushlight Club. This club consists of collectors and others interested in old lamps used prior to the kerosene age. The club meets each month for lectures, discussions and demonstrations of old methods of lighting, and this book was written by a club member in celebration of their twenty-fifth year.

In "Flickering Flames" the author traces the development of domestic lighting from prehistoric beginnings to the still remembered lamps of the Victorian era in a direct style which highlights the results of more than 25 years of research and association with students and collectors of old lighting devices. Lighting forms, fuels and technical advances are treated in clear-cut terms under headings such as float lamps, pan lamps and crusies. Terms like Betty and kettle lamps, drop burners and the whale oil burners attributed to Benjamin Franklin become familiar. More than 95 full-page plates with hundreds of different lighting devices illustrate the text.

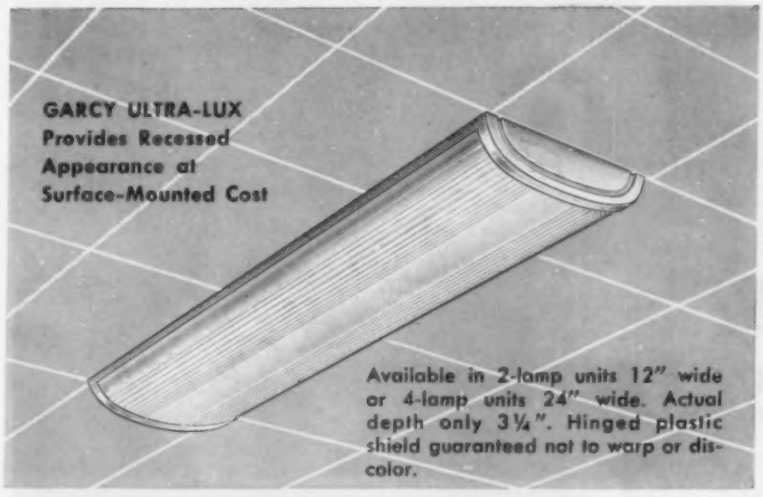
Here is a succinct, authoritative record with a convenient separately illustrated glossary that brings the intricacies of domestic lighting into perspective, with suggestions and a bibliography for specialized study; a book of value to libraries, collectors, dealers, and all students of antiques and persons interested in Americana generally. The book seems destined to become the standard text in a field that is rapidly gaining wide popular interest.

Leroy Thwing is author of many articles in *Antiques, Antiques Journal, Technology Review, New York Sun* and *The Rushlight*, of which he was editor for many years. — REVIEWED BY JULIUS DANIELS.

**How to Become a Professional Engineer** by John Constance, published by McGraw-Hill, 330 West 42nd Street, New York 36, N. Y., 288 pp., 26 illustrations, $5.50.

This guide to obtaining a professional engineer's license, written by a Registered P.E. in New York and New Jersey

(*Continued on page 48A*)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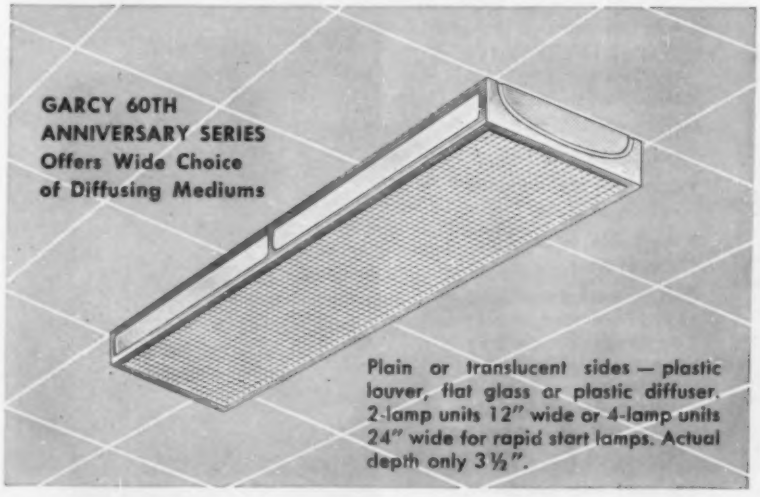
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Only the exclusive process of the American Louver Company is covered by these patents:
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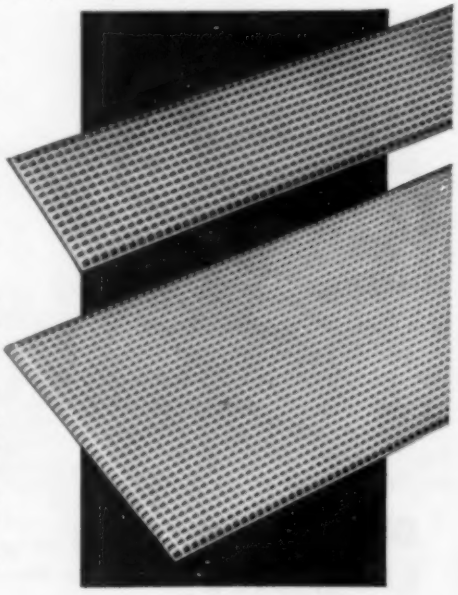
The next time you order, specify the ultimate in modern plastic louvers — get AMERICAN!



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american louver company

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(Continued from page 47A)

who has been preparing engineers for licenses for 15 years, is intended to cover every phase of the certification process. It contains information on the seven basic requirements for licenses, summaries of various state registration laws, pointers on how to prepare for both written and oral examinations, how to select qualifying experience (and write it up), what to look for in refresher courses and how to achieve multiple state registration. The book is applicable in all states, covering what all licensing boards aim for. It also includes extensive appendices listing the names and addresses of state board secretaries, accredited schools and recommended texts.

**Proceedings** of the American Society for Testing Materials, Vol. 57, 1957 Edition, published by the American Society for Testing Materials, 1916 Race St., Philadelphia, Pa., 1430 pp. $12.00.

This year's edition of this annual publication recording the Society's accomplishments includes 66 technical committee reports and 52 technical papers with discussion, as well as the annual report of the Board of Directors, a summary of the Annual Meeting, the President's Address and facts and figures relative to Society business.

**Westinghouse Lighting Handbook,** published by Westinghouse Electric Corp., Lamp Division, Bloomfield, N. J., 256 pp., $3.00.

A new edition of this *Handbook* first published in 1941, is now available from the Westinghouse Lamp Division in Bloomfield, N. J. The book includes a full-color fold-out page of the electromagnetic spectrum, information on distribution and light measurement, a revised section on sources, information on coefficients of utilization and maintenance factors and tables of recommended illumination levels, as well as individual chapters on the lighting of many specific areas.

**American Standard C82.1-1958,** Specifications for Fluorescent Lamp Ballasts (50 cents), intended to be used in conjunction with the C78 series of American Standard Dimensional and Electrical Characteristics of Electric Discharge Lamps, is available from the American Standards Association, Dept. PR2, 40 East 45th Street, New York 17, N. Y.

**Lighting Maintenance Manual,** available on letterhead request from Champion Lamp Works, Lynn, Mass.

New 48-page edition presents the principles and advantages of good lighting maintenance practice.

# NEW MEMBERS

At the meeting of the I.E.S. Council Executive Committee held at Wheeling, W. Va. on July 17, 1958, the following were elected to membership. Names marked * are transfers from Associate Member Grade. Names marked ** are transfers from Student Member Grade.

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*Weiman, M. R., Associated Engineers, Peoria, Ill.

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Riley, J. H., Jack Riley Associates, Chicago, Ill.

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Takacs, R. J., Cleveland Electric Illuminating Co., Cleveland, Ohio.

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Chu, T. T. C., U.S.A. Engineer Dist. Okinawa, San Francisco, Calif.

Etzkorn, W .V., Etson Corp., Oakland, Calif.

McKillican, R. E., Pacific Gas & Electric Co., San Francisco, Calif.

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Yoshimoto, Masaru, Division of Highways, State of California, Fresno, Calif.

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Humphrey, Sam, Progress Manufacturing Co. Inc., Kansas City, Mo.

Marshall, E. L., Mid-West Chandelier Co., North Kansas City, Mo.

(*Continued on page* 50A)

NO. 6163 — 24" Diameter (left) Wired for four 100W lamps plus a 500W R-40 floodlamp for concentrated downlighting thru the louver bottom.

NO. 6181 — 12" Diam. Cylinder (right) Wired for three 100W lamps plus a 500W R-40 floodlamp for concentrated downlighting thru the louver bottom.

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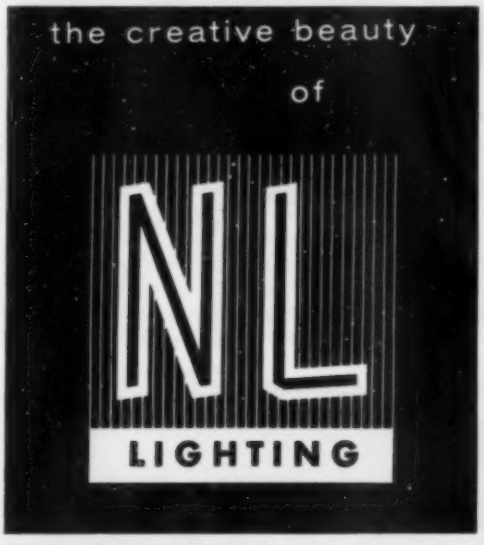

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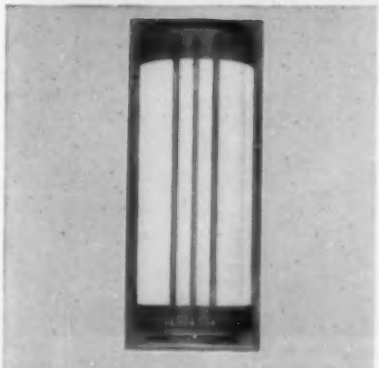

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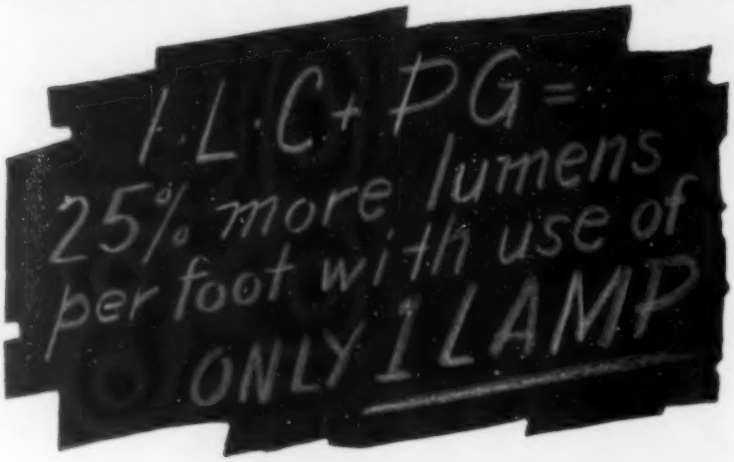


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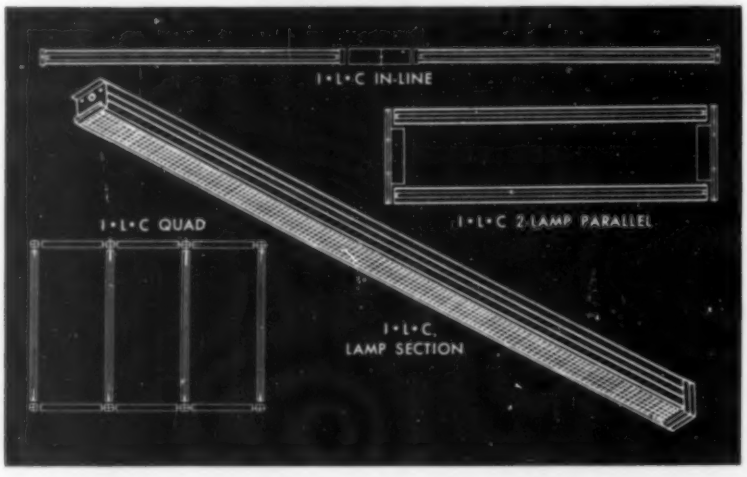


**I·L·C IN-LINE:** Continuous single row tandem arrangements of two or more lamps with associated ballast enclosures and hangers.

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*For complete details send for Bulletin S257*

581 A

**SILVRAY LIGHTING, INC.**
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(*Continued from page* 49A)

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*(Continued on page 53A)*


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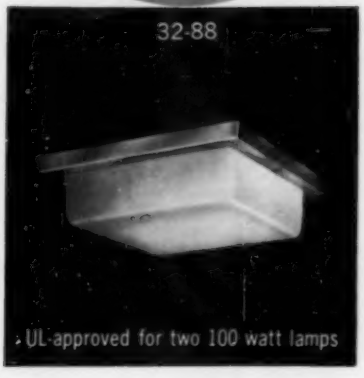

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(*Continued from page 51A*)

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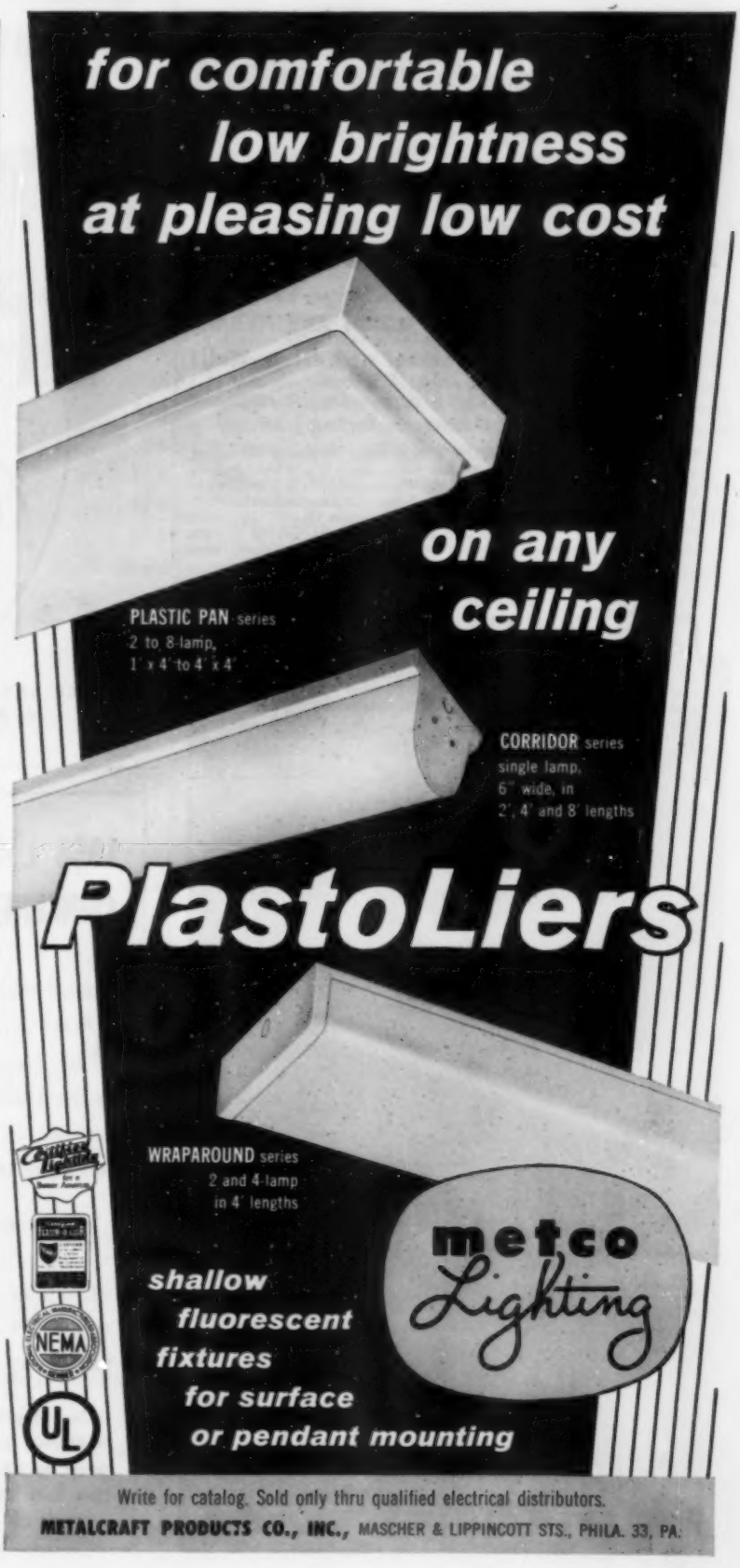

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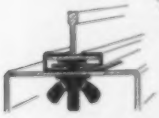

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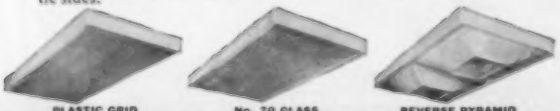

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... the conductor raised his baton. Backstage, a hand set a reading on a dimmer. The concert mood of sound and light filled the Teaneck Jewish Center social hall.

**Lighting for this arena of varied interests** demanded a special control system of Architect Max M. Simon, the engineering firm of Barnett-Ross, and Century. The system was built on a Century Interplug Switchboard and Dimmerpak unit.

**Complete control concentrated in simplest terms** was provided by Century Interplug Switchboard and Dimmerpak system. Within minutes, any amateur can learn to simulate a stroke of lightning, a sunset, or any of a full gamut of color, form, movement and intensity effects. Dimmers in each Dimmerpak add this dramatic power with quick-changing or static effects, needed for dramatizing or glamorizing the events of a community center or school auditorium, a museum or manufacturer showroom, exhibit hall or nightclub.

**Century Interplug & Dimmerpak systems** can be built, custom fashion, to provide intricate lighting controls easily, economically. These addable units can be combined and installed at minimal cost, can be expanded with additional units as needs or budgets grow. Send for complete data, from Century... the name in lights.

CENTURY LIGHTING, INC. 521 West 43rd Street, New York 36.
1477 N.E. 129th Street, North Miami, Fla.
1820-40 Berkeley Street, Santa Monica, Calif.

**Striking, pleasant accent** for an up-to-date building corridor: Sylvania recessed lighting troffers continuous-row mounted with acoustical ceiling materials.

**Individually mounted** troffers, imaginatively arranged, combine attractive design with good basic light distribution for company cafeterias and lounges.

**Ribbons of light** – Sylvania recessed troffer lighting can be mounted in continuous rows and spaced for high lighting levels in modern business offices.

# Introducing . . .

## a new Shallow Troffer Series by Sylvania— recessed lighting for today's building methods

For the aesthetically minded lighting designer or installer, who has to cope with the modern trend to lower ceilings and shallower plenum spaces . . . here is a new approach to recessed lighting. It's Sylvania's new Shallow Troffer Series, fixtures which measure only 5½" from top to bottom—and, in many cases, require no additional depth for mounting.

Available in a variety of models, in both one- and two-foot widths, the Sylvania Shallow Troffer makes this popular form of lighting *practical and usable* in all new buildings, with full illumination efficiency. The units are fully recessed. Unsightly latches are hidden. Even the hinges don't show . . . only the clean straight lines of the frame and attractively styled shielding.

Sylvania Shallow Troffers are carefully engineered to utilize the full plenum space. Lay-in type troffers are provided for Z-spline and inverted-T ceilings. Exclusive *snap-up hanger* provides quick, secure mounting for most other types of acoustical ceilings (see sketches below). Ask your Sylvania Fixture Specialist for full details, or write direct for FREE new folder of specification data.

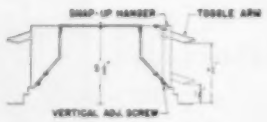
Sylvania Electric Products Inc.
Dept. H30, Lighting Division – Fixtures
One 48th Street, Wheeling, W. Va.

**SYLVANIA**

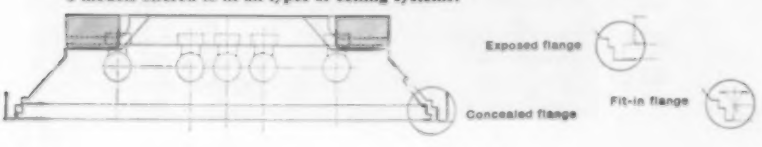
**Fluorescent Lighting Fixtures and Systems**

**Best fixture value in every price range**

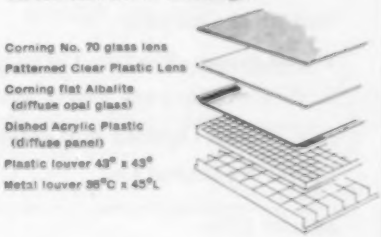
**New 5¼" high troffer** utilizes full plenum space. Exclusive *snap-up hanger*, with vertical adjusting screw, provides secure side-mounting for acoustical ceilings with support elements parallel to troffer. End-mounting brackets also available.




**3 models offered to fit all types of ceiling systems:**



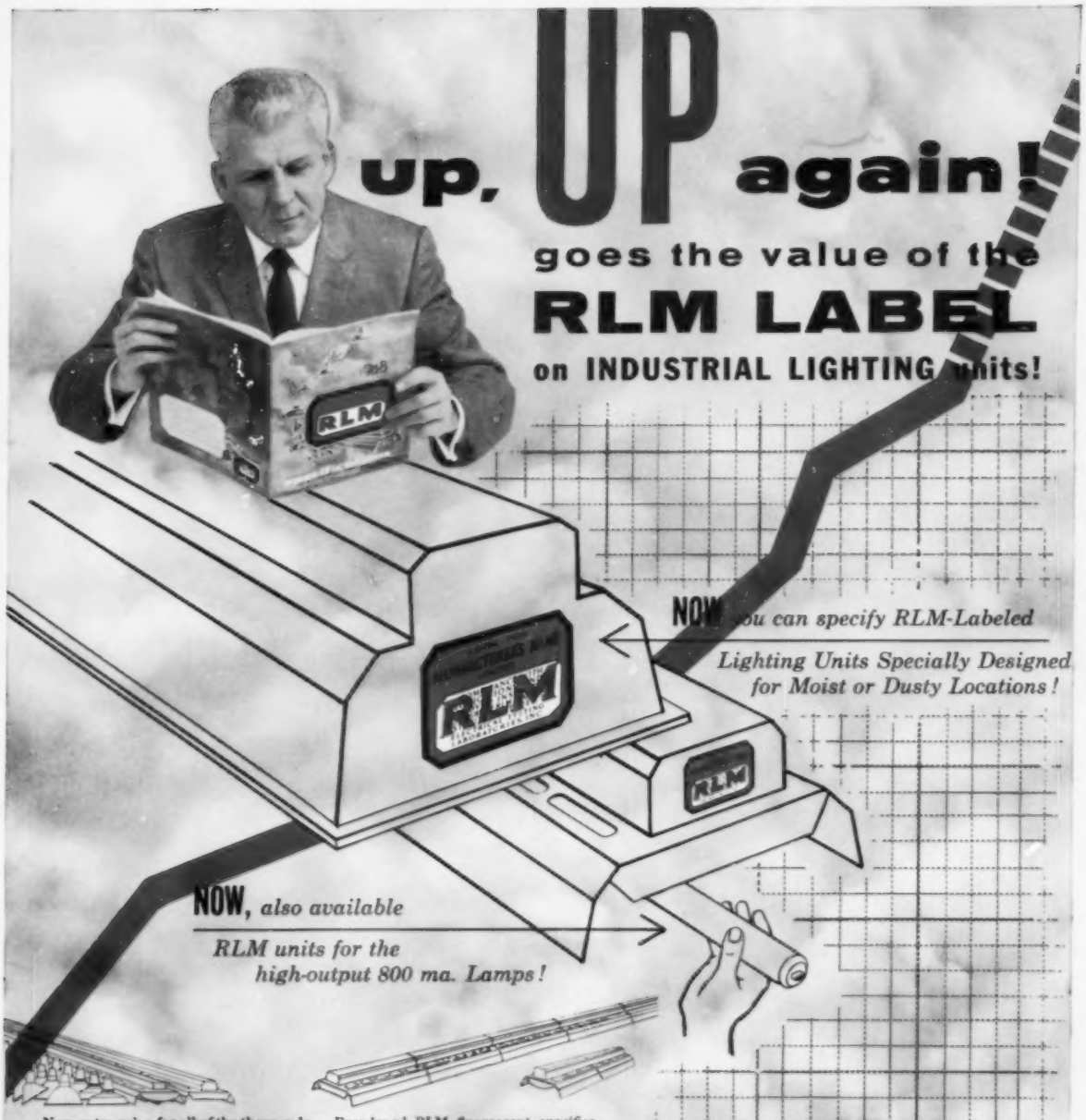

**All standard troffer shieldings:**


Corning No. 70 glass lens
Patterned Clear Plastic Lens
Corning flat Albalite (diffuse opal glass)
Dished Acrylic Plastic (diffuse panel)
Plastic louver 45° x 45°
Metal louver 35°C x 45°L

LIGHTING • TELEVISION • RADIO • ELECTRONICS • PHOTOGRAPHY • ATOMIC ENERGY • CHEMISTRY-METALLURGY

# up, UP again!

## goes the value of the RLM LABEL on INDUSTRIAL LIGHTING units!

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**NOW,** *also available RLM units for the high-output 800 ma. Lamps!*



Now, extra value for all of the thousands of types, sizes and styles of fluorescent and incandescent lighting units which are available with the RLM Label!

Broadened RLM fluorescent specifications cover individual and continuous row tandem mountings for simplified installation, more rigid construction.

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New RLM Specs for units utilizing high-output 800 milliampere lamps, point up the thorough broadening of RLM Standards to keep pace with latest lighting developments. In fact, every specification in the new RLM Book has been strengthened, made more embracing, revised UP! Send for your FREE COPY of the 1958 RLM Specifications Book.

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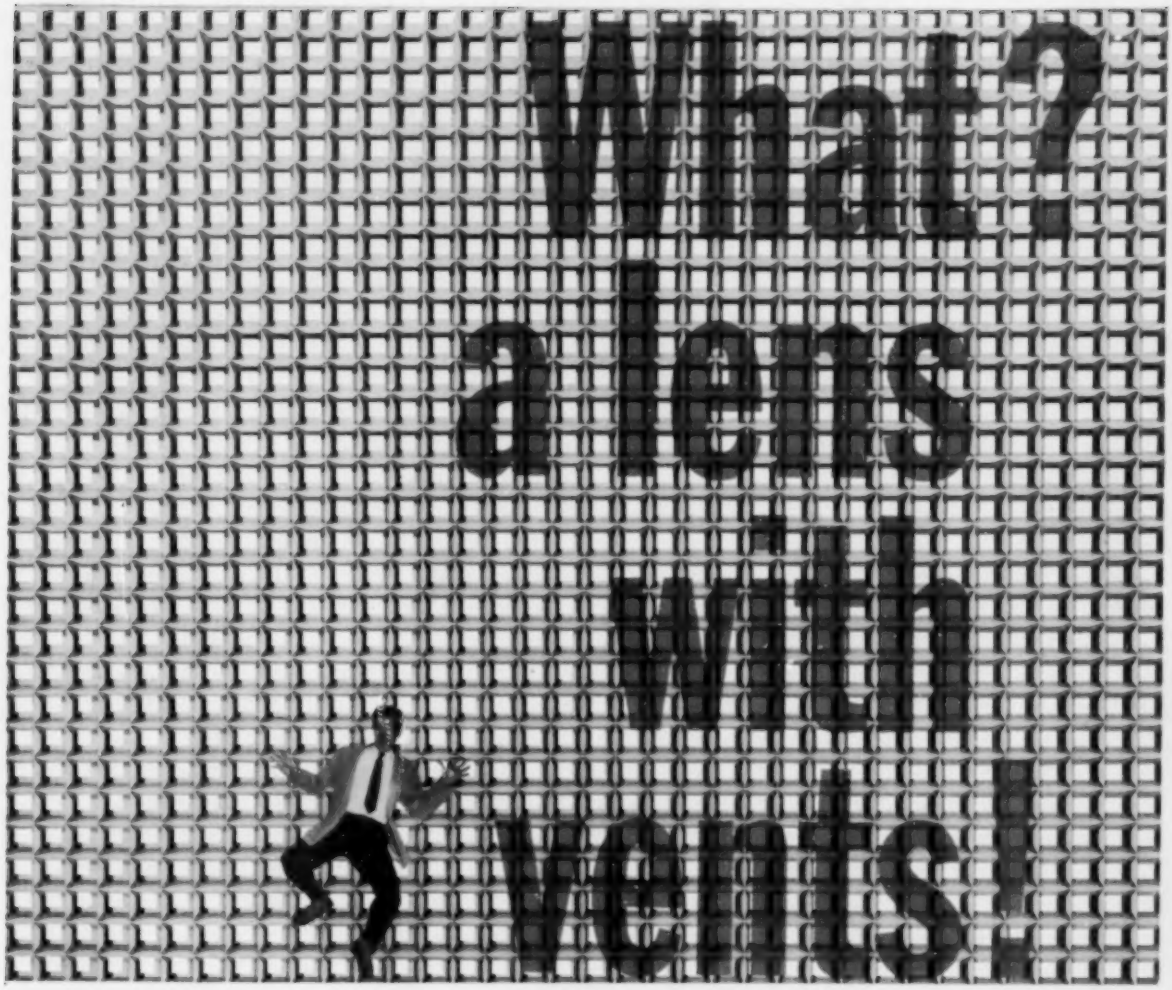
*This label identifies the RLM-certified lighting equipment of 27 leading manufacturers*

RC-215

**For Free 1958 Specifications Book, write RLM Standards Institute, Suite 8238, 326 West Madison Street, Chicago, Illinois.**




## ballast men are amazed about Guth Prismoid-GrateLite*

When a recent visitor to our plant saw a section of the new Guth Prismoid-GrateLite lying flat on white paper, his eyes sparkled.

He held it up and exclaimed, "It's great! It's got holes!"

Our visitor was a ballast salesman, and he was mighty happy that the gorgeous new Prismoid has holes. As he explained, almost everyone is enclosing ballasts, cooping up the heat, cutting down fixture depth... making it tougher than ever for ballasts to serve their legitimate lives.

But here is Prismoid, a prismatic louver-lens *with holes!* The ballast salesman said, "It's certainly a step in the right direction!"

Thanks to Prismoid's *breathing action* ballasts get ventilation, lamps are cooled and the flowing air helps keep lamps, Prismoid and fixtures up to 50% cleaner than solid panels.

Guth

PRISMOID
GRATELITE
Prismatic Louver-Lens

*T. M. Reg. U. S. & Can. Pats. Pend.

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